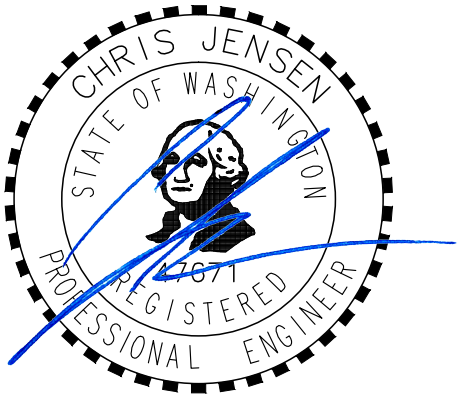
BARGHAUSEN

# TECHNICAL INFORMATION REPORT

## Brown Bear - New Build

55 N.W. Gilman Boulevard
Issaquah, Washington

City/County File No. TBD




04/02/2020

Prepared for:
Car Wash Enterprises, Inc
3977 Leary Way N.W.
Seattle, WA

April 3, 2020
Our Job No. 20693

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BRANCH OFFICES: TUMWATER, WA KLAMATH FALLS, OR LONG BEACH, CA ROSEVILLE, CA SAN DIEGO, CA
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# TECHNICAL INFORMATION REPORT

Barghausen Consulting Engineers, Inc.

**Brown Bear - n=New Build**

Issaquah, Washington

Our Job No. 20693

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# Tab 1.0

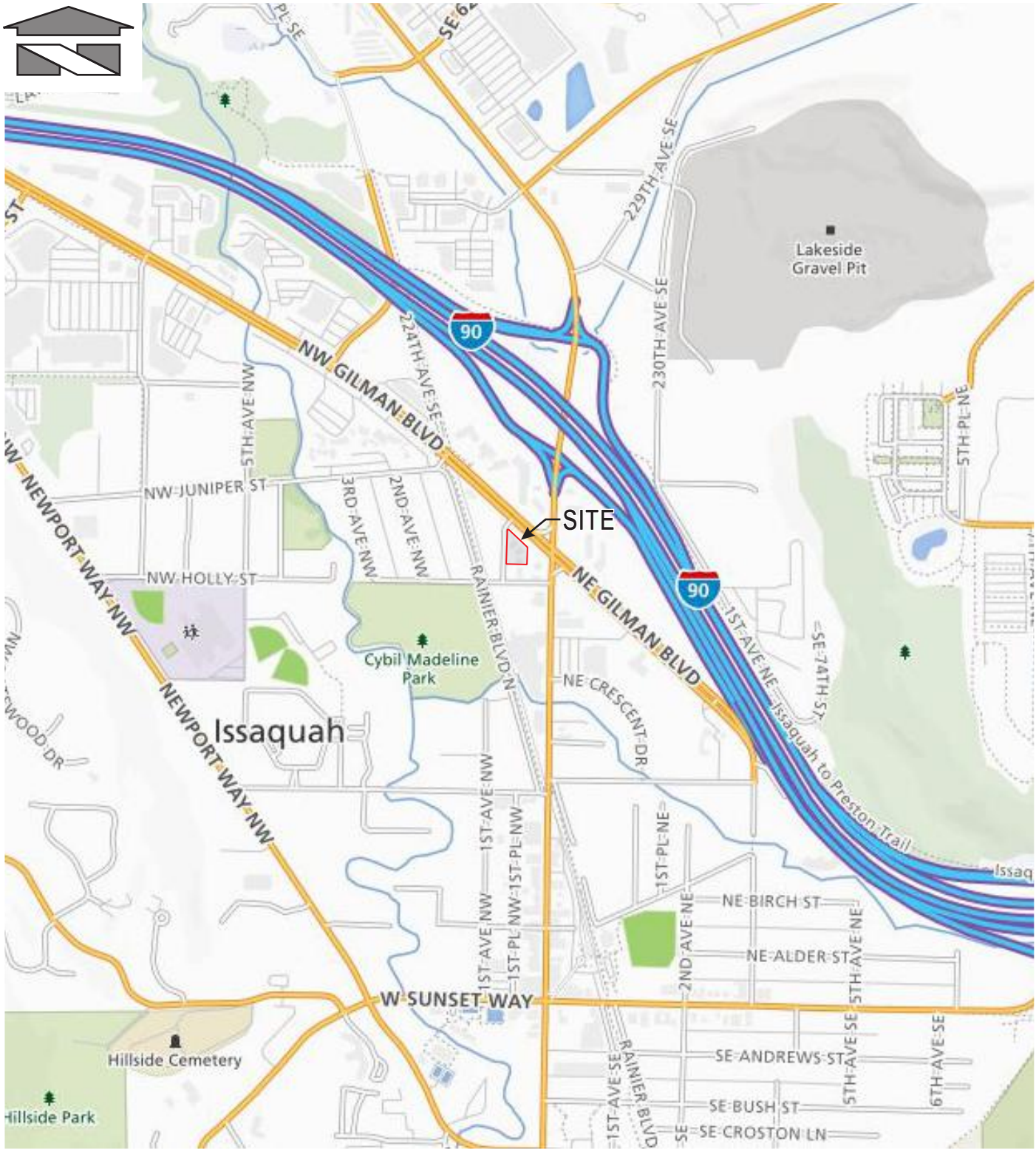
## 1.0 PROJECT OVERVIEW

The proposed project site is located within Section 28, Township 24 North, Range 6 East of the Willamette Meridian with a total tax parcel area of 0.42 acres. More specifically, the site is located at 55 N.W. Gilman Blvd, Issaquah, WA 98027. The site consists of a single tax parcel with the number 8843500440. See Figure 1.1-Vicinity Map in this section for the location of the proposed project site.

The proposed development includes the construction of a 2,100-square-foot Brown Bear Car Wash, Auto Sentry Canopy, a covered trash enclosure, and replaced driving surface. The project will involve the removal of an existing gas station, and paved driving surface. The site is generally flat, with mild sloping down gradient from southeast to northwest. There do not appear to be any mapped or observed critical areas within the site's immediate vicinity. Existing site vegetation primarily consists of lawn grass, and landscaping shrubs.

The project site consists of a single Threshold Discharge Area and intends to match the existing drainage patterns on site. This project proposes more than 10,000 square feet of new and replaced impervious surface, and therefore all minimum requirements must be evaluated as specified in the flow chart (Figure 2) of this report. As part of the drainage requirements, the project intends to detain runoff generated from the site improvements to the maximum extent feasible, and comply with the Standard Flow Control Requirement per section 2.4.7 MR#7: Flow Control of the City of Issaquah 2017 Stormwater Design Manual Addendum. Additionally, this project proposes more than 5,000 square feet of new and replaced pollution generating hard surface to a commercial project site and therefore must provide enhanced water quality treatment per Section 2.4.6 MR#6: Runoff Treatment. This Stormwater Site Plan (TIR) will serve to address the drainage requirements contained within the City of Issaquah 2017 Stormwater Design Manual Addendum and the 2014 DOE Western Washington Stormwater Manual. Please see the remainder of this report for the project's design intent for mitigating any adverse impacts as a result of on-site improvements.

# Figure 1.1
# Vicinity Map




REFERENCE: Rand McNally (2019)

Scale:
Horizontal: **N.T.S.** Vertical: **N/A**

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*For:*
Brown Bear Car Wash
Issaquah, Washington

Job Number
20693

*Title:*
VICINITY MAP

DATE: 10/24/19

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# Tab 2.0

## 2.0 CONDITIONS AND REQUIREMENTS SUMMARY

This section contains the following information:

2.1 Analysis of the Minimum Requirements

## 2.1 Analysis of the Minimum Requirements

| MINIMUM REQUIREMENTS | HOW PROJECT HAS ADDRESSED REQUIREMENT |
|---|---|
| **No. 1: Preparation of Stormwater Site Plans** | This Minimum Requirement has been fulfilled by the preparation and completion of this Stormwater Site Plan (TIR). |
| **No. 2: Construction Stormwater Pollution Prevention (SWPP)** | A completed Construction Stormwater Pollution Prevention Plan (SWPPP) will be submitted separately from, or together with, this report during Final Engineering Review. |
| **No. 3: Source Control of Pollution** | All known, available, and reasonable Source Control BMPs will be applied to this project in accordance with those applicable to a car wash project. At a minimum, the parking lot will be swept on a regular basis, and the owner will be educated about the proper use of pesticides and fertilizers. Per section 1.2.4 of the 2017 COI Stormwater Design Manual Addendum, the trash enclosure will be graded to prevent run-on from adjacent areas, and will drain directly to the sanitary sewer system. Additionally the trash enclosure will be constructed with a rooftop to minimize stormwater contact with trash and associated pollutants. Car washing areas will drain directly to the sewer system, and all chemicals will be stored within the carwash structure. Per S431 BMPs for Washing and Steam Cleaning Vehicles/Equipment/Building structures, all vehicle washing will take place within the proposed structure, and wash water will be collected by the carwash tunnel trench and discharged to the sanitary sewer system. Wash water will be isolated from stormwater runoff. |
| **No. 4: Preservation of Natural Drainage Systems and Outfalls** | The existing site appears to collect runoff into catch basins located on-site and discharge to the public stormwater conveyance system within N.W. Gilman Avenue. The proposed drainage design will collect on-site runoff and discharge stormwater to the same public stormwater conveyance system, thus preserving the existing drainage patterns. |
| **No. 5: On-site Stormwater Management** | This project triggers Minimum Requirements Nos. 1 through 9, and is defined as a redevelopment on a parcel inside the UGA; therefore, this project must either apply the Low Impacted Development Performance Standard and BMP T5.13: Post Construction Soil Quality and Depth; or evaluate the feasibility of the BMPs in List No. 2. This project will choose to evaluate the feasibility of BMPs from List No. 2 and apply them to the maximum extent feasible; however, it appears that all on-site stormwater management BMPs for proposed impervious surfaces are infeasible for this site. |
| **No. 6: Runoff Treatment** | This project proposes greater than 5,000 square feet of pollution generating hard surface, and must provide a water quality treatment facility. This site is defined as a commercial project and therefore, Enhanced Water Quality Treatment, and phosphorus removal must be provided. Runoff treatment will be provided by a Modular Wetland Water Quality System. This project is considered a high-use site, and will provide an on-line oil/water separator located downstream of the detention facility for oil control. |

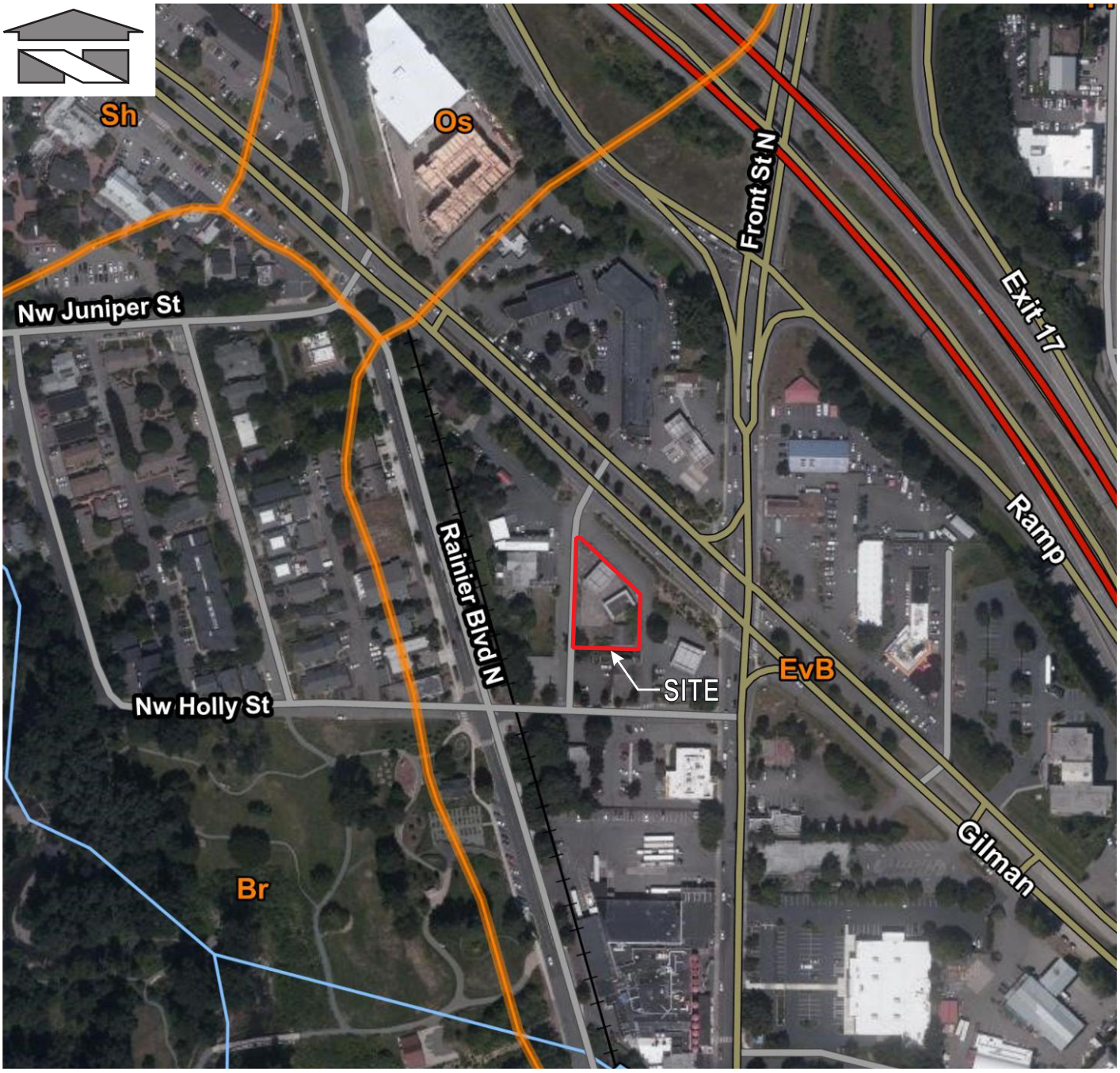
| | |
|---|---|
| **No. 7: Flow Control** | This project proposes more than 10,000 square feet of new and replaced hard surface, and must provide flow control. A detention facility has been sized with WHHM2012 to match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50 percent of the 2-year recurrence interval peak flow up to the full 50-year peak flow. |
| **No. 8: Wetlands Protection** | There are no documented wetlands recorded on-site. |
| **No. 9: Operation and Maintenance** | The drainage facility for this project will be a private facility, owned and maintained by the owner. An Operation and Maintenance Manual will be provided in Section 9.0 of this Stormwater Site Plan during Final Engineering Review. |

# Tab 3.0

## 3.0 EXISTING CONDITIONS SUMMARY

The project site is located at the southwest corner of the intersection between N.W. Gilman Boulevard, and 1st Avenue N.W. Both 1st Avenue N.W., and Gilman are developed in their existing conditions. A paved alley runs along the site's east boundary. The property to the south is currently occupied by a commercial business. The majority of the site surface is covered by asphalt and concrete. Existing structures include a gas station canopy, fuel pumps, and tanks, and two existing structures. The existing impervious surfaces cover greater than 35 percent of the site's total area. The existing topography generally slopes from the southeast to the northwest at grades of 1 to 5 percent. The site soils have been identified as Everett Very Gravelly Sandy Loam, 0 to 8 percent slopes on the USDA Web Soil Survey Map. A soil investigation was conducted by Aspect Consulting, and provided information for this project's geotechnical report. The investigation determined the sites soils specifically consist of a mix between fill, and alluvium. The fill consists of "medium dense to very dense, moist, brown and gray, silty gravel with sand (GM)". The alluvium is described as dense to very dense, wet, brown and gray, gravel and sand with varying amount of silt (GM and SM). There do not appear to be any critical areas including wetlands or steep slopes within the immediate vicinity of the site; however, this site has been identified as being located within the Critical Aquifer Recharge Area Class 1 Zone and Sammamish Plateau Water District's Wellhead Protection Zone.

# Figure 3.1
# Soil Survey Map




REFERENCE: USDA, Natural Resources Conservation Service

| LEGEND: | HSG |
|---|---|
| EvB = Everett very gravelly sandy loam, 0-8% slopes | A |

Scale:
Horizontal: **N.T.S.** Vertical: **N/A**

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*For:*
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Issaquah, Washington

*Title:*
SOIL SURVEY MAP

Job Number
20693

DATE: 10/24/19

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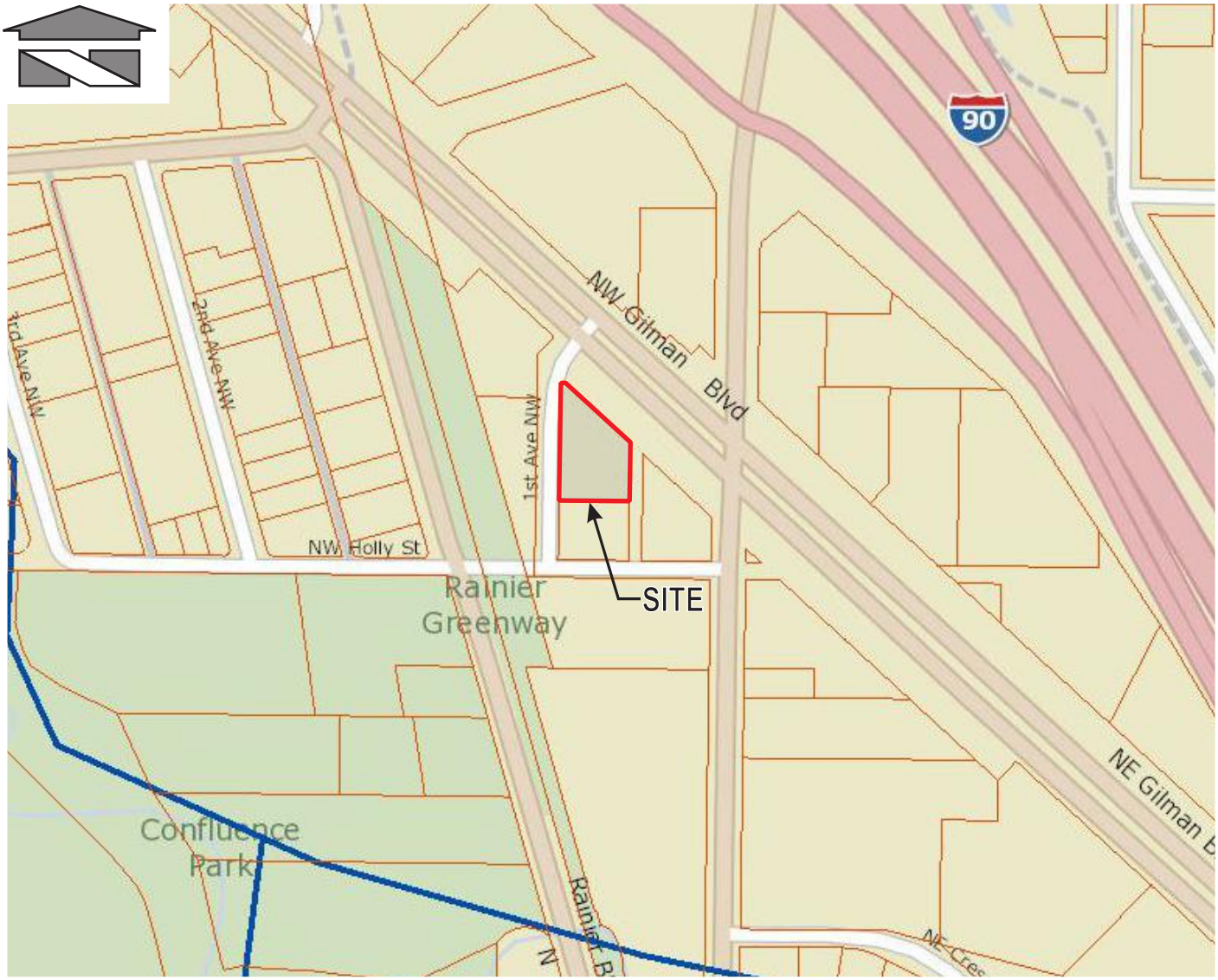
# Figure 3.2
# Sensitive Areas Map




## Legend

- Parcels
- Potential landslide hazard areas (2016, see explanation--->)
- Potential steep slope hazard areas (2016, see explanation--->)
- Erosion hazard (1990 SAO)
- Seismic hazard (1990 SAO)
- Coal mine hazard (1990 SAO)
- class 1
- class 2 perennial
- class 2 salmonid
- class 3
- unclassified
- Wetland (1990 SAO)

REFERENCE: King County iMAP (2019)

Scale:
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Brown Bear Car Wash
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*Title:*
SENSITIVE AREAS MAP

Job Number
20693

DATE: 10/24/19

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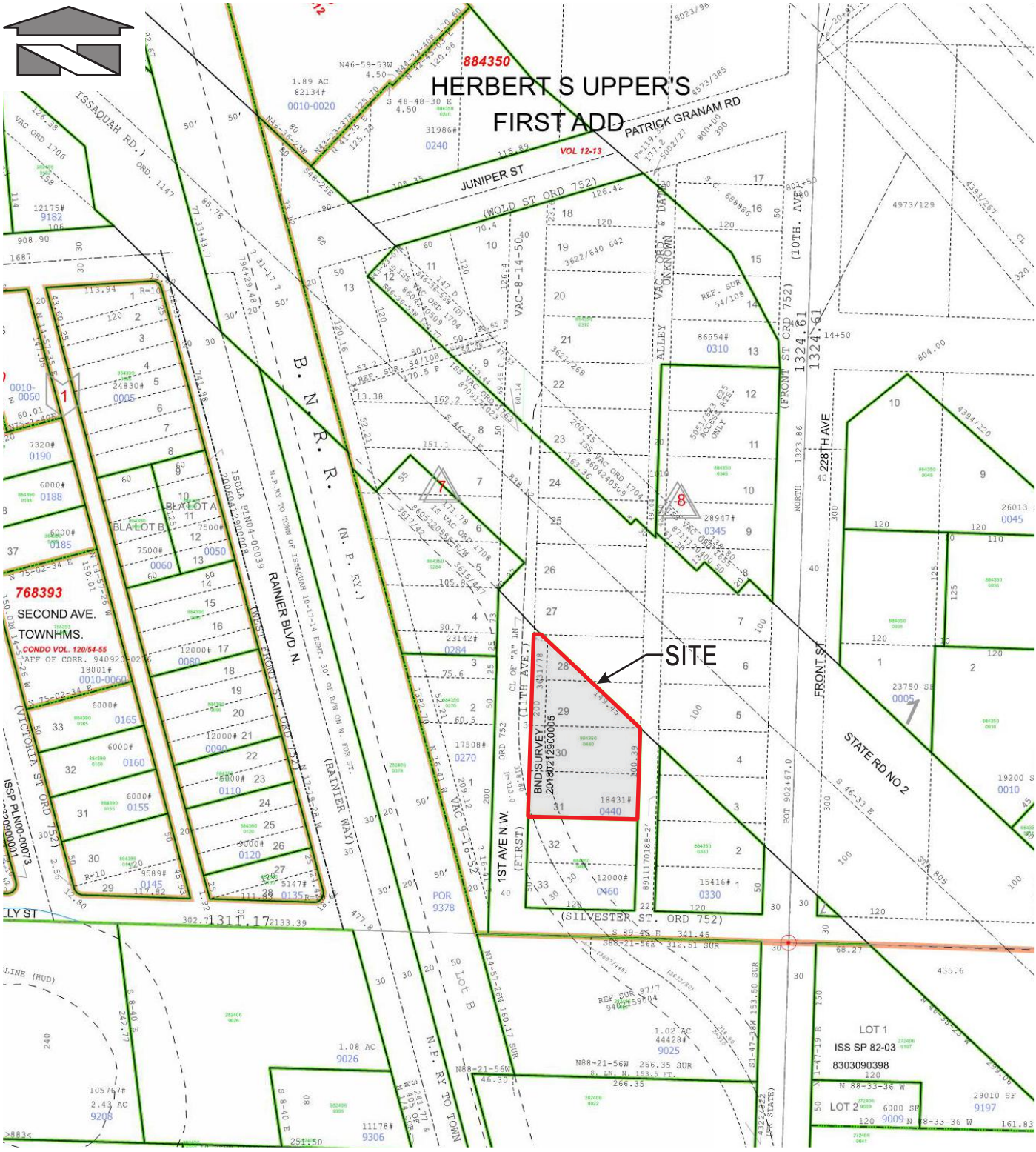
Figure 3.3
Assessor's Map




REFERENCE: King County Department of Assessments (July 2019)

| | | |
|---|---|---|
| Scale: Horizontal: **N.T.S.** Vertical: **N/A** | *For:* Brown Bear Car Wash<br>Issaquah, Washington | Job Number<br>20693 |
| **Barghausen Consulting Engineers, Inc.**<br>18215 72nd Avenue South<br>Kent, WA 98032<br>425.251.6222 **barghausen.com** | *Title:* ASSESSOR MAP | DATE: 10/24/19 |

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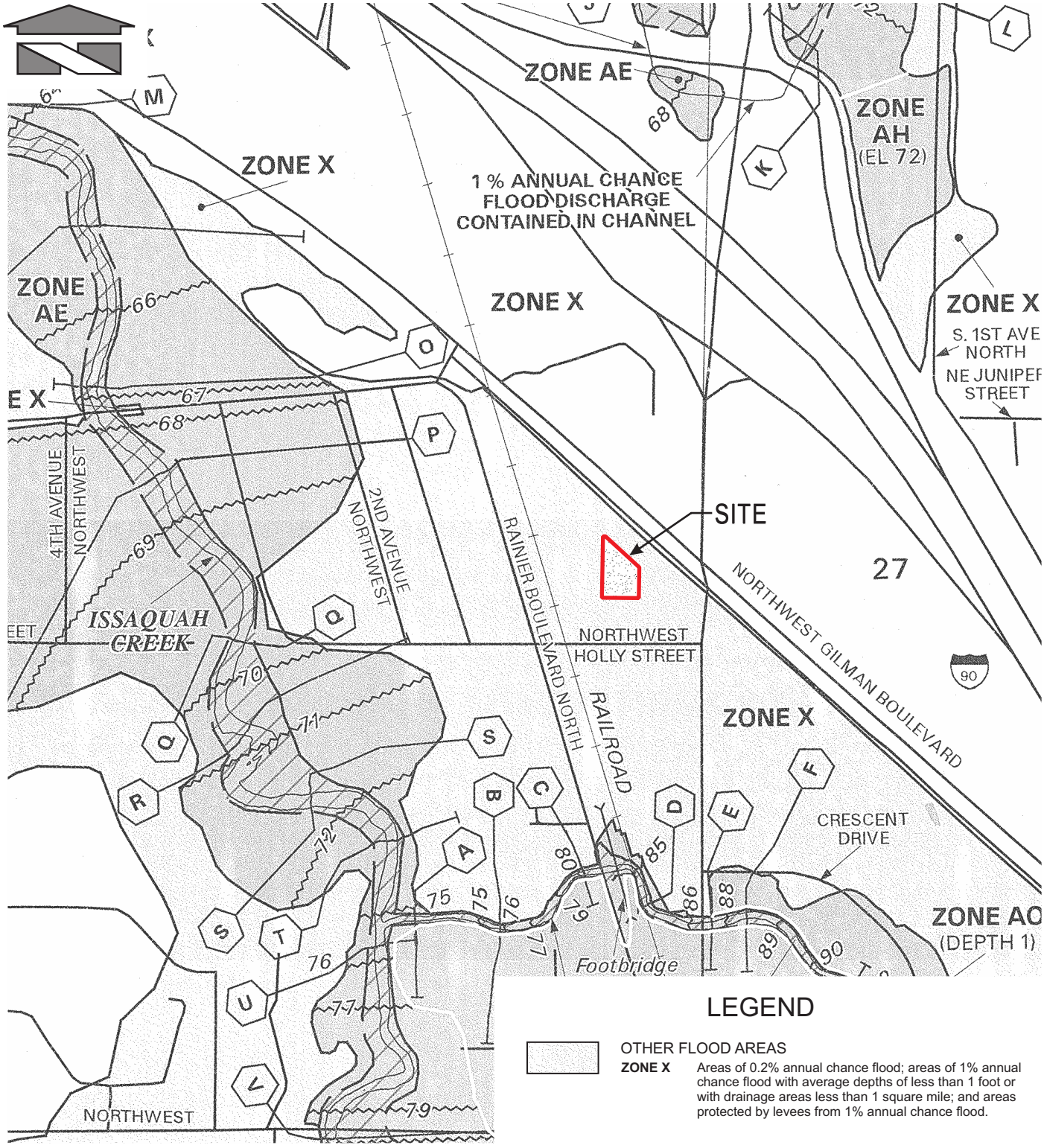
Figure 3.4
FEMA Map




## LEGEND

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

REFERENCE: Federal Emergency Management Agency (Portion of Map 53033C0691H, April 2005)

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*For:*
Brown Bear Car Wash
Issaquah, Washington

*Title:*
FEMA MAP

Job Number
20693

DATE: 10/24/19

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# Tab 4.0

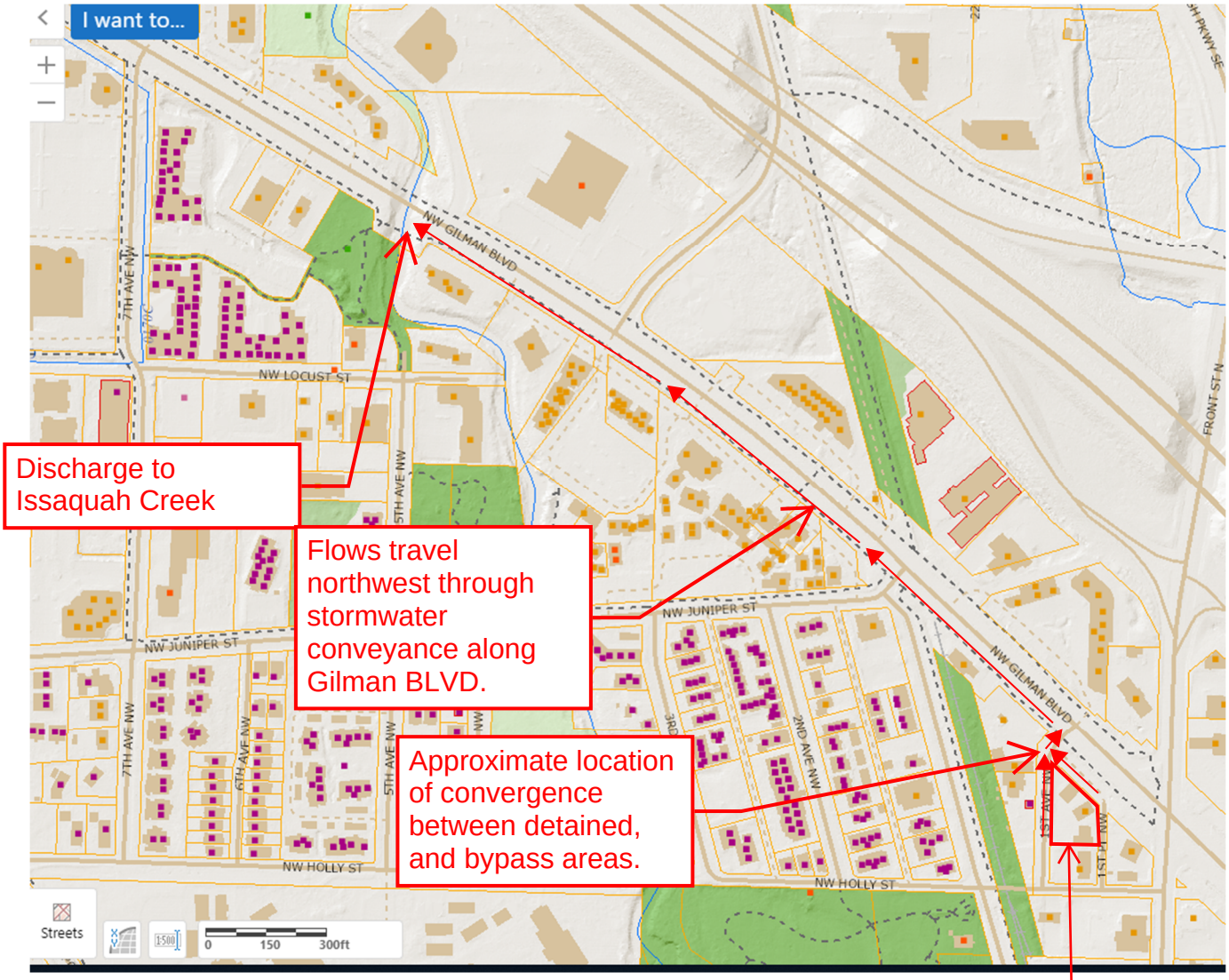
## 4.0 OFF-SITE ANALYSIS REPORT

The immediate upstream basin of the site consists of a single property to the south, and both 1st Avenue N.W. to the west of the site, and a paved alley to the east of the site. Runoff from these upstream surfaces appears to collect in the conveyance systems within 1st Avenue N.W. and the alley. It is not anticipated that runoff from the proposed development will contribute a negative impact on upstream properties.

The immediate downstream basin of the site appears to be confined to N.W. Gilman Boulevard. Runoff from N.W. Gilman Boulevard is collected into catch basins and is conveyed northwest. It appears that stormwater within this conveyance system ultimately discharges to Issaquah Creek, before reaching Lake Sammamish. This project intends to detain stormwater runoff to the maximum extent feasible to meet flow control standards specified in MR#7, and proposes a net reduction of impervious surface. Additionally this project intends to provide enhanced stormwater quality treatment, and is not anticipated to create a negative impact on the downstream basin or receiving freshwater bodies.

Figure 4.1
Downstream Map

# Downstream Map



# Tab 5.0

## 5.0 PERMANENT STORMWATER CONTROL PLAN

This section contains the following information:

5.1 Existing Site Hydrology

5.2 Developed Site Hydrology

5.3 Performance Standards and Goals

5.4 Low Impact Development Features

5.5 Flow Control System

5.6 Water Quality System

5.7 Conveyance System Analysis and Design

## 5.1 Existing Site Hydrology

The existing site collects runoff into catch basins located on-site and within adjacent public right-of-ways. The existing surface is primarily impervious, consisting of rooftops, concrete, and asphalt. Limited vegetation exists on-site.

### Predeveloped Basins

The predeveloped basin, tributary to the site discharge location, can be broken down as follows:

| Impervious | Pervious | Total Area |
|---|---|---|
| 0.443 Ac | 0.056 Ac | 0.499 Ac |

Areas include both the tax parcel surfaces, and surfaces within the public ROW

For a detailed explanation of the procedures used for the sizing of the proposed drainage facility please reference Section 5.4 of this report.

Figure 5.1
Pre-developed
Basin Map

# PRE-DEVELOPED BASIN MAP

FOR

# BROWN BEAR CAR WASH

SE $\frac{1}{4}$ OF NE $\frac{1}{4}$ OF SEC. 28, TWN. 24 N, RGE. 6 E, W.M.
CITY OF ISSAQUAH, KING COUNTY, WASHINGTON

PRE-DEVELOPED BASIN AREAS:

EXISTING IMPERVIOUS/PERVIOUS AREAS

| | |
|---|---|
| BUILDINGS: | 4,382 SF (0.100 AC) |
| DRIVING SURFACE, CONC. WALKWAYS, CURBS: | 14,893 SF (0.342 AC) |
| TOTAL EXISTING IMPERVIOUS: | 19,275 SF (0.442 AC) |
| LANDSCAPE: | 2,449 SF (0.055 AC) |
| TOTAL BASIN AREA: | 21,724 SF (0.499 AC) |

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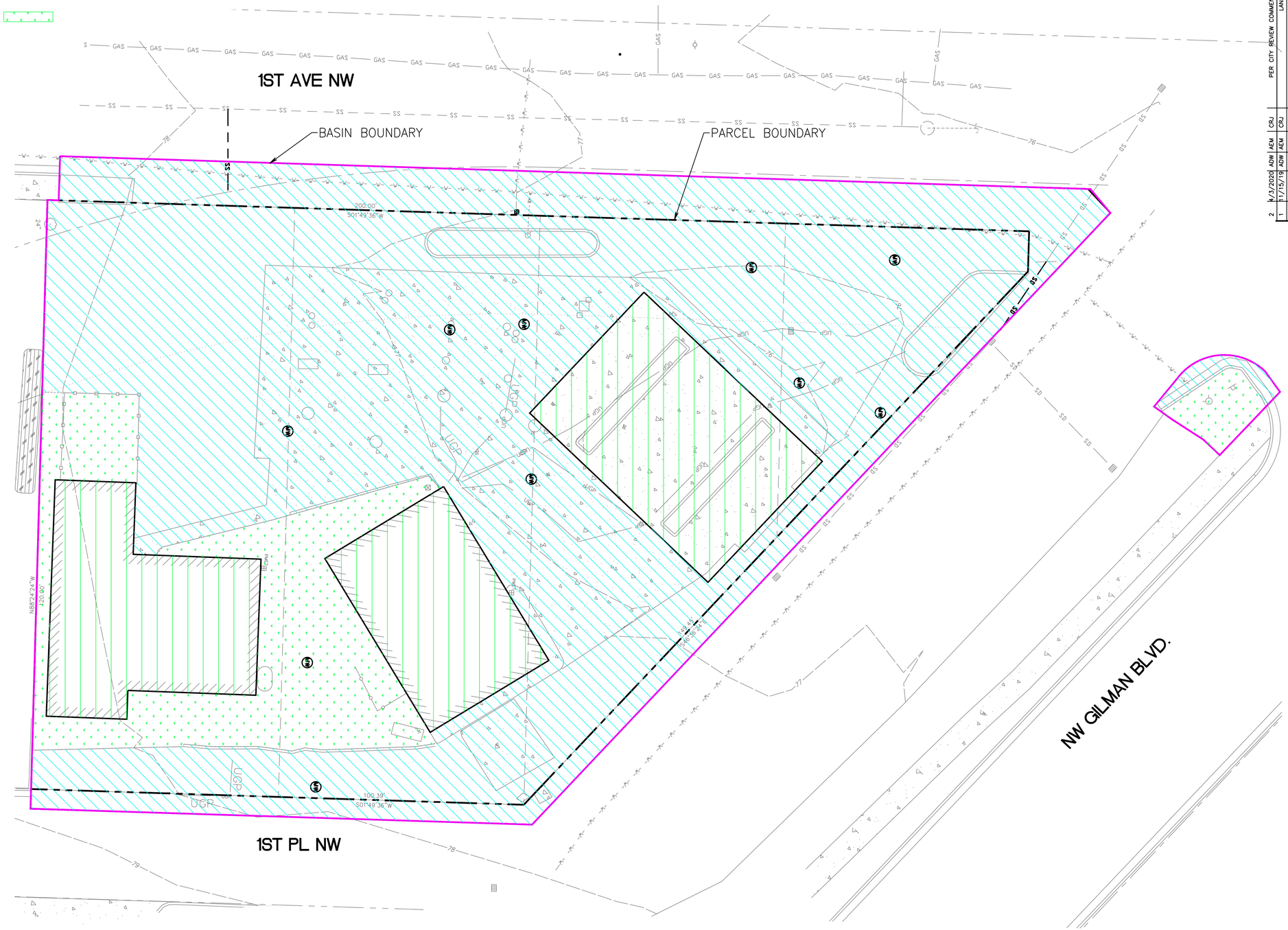
0 5 10 20




Know what's **below.** **Call** before you dig. Dial 811

| No. | Date | By | Ckd. | Appr. | Revision |
|---|---|---|---|---|---|
| 2 | 4/3/2020 | ADW | AEM | CRJ | PER CITY REVIEW COMMENTS RECIEVED 02/19/2020 |
| 1 | 11/15/19 | ADW | AEM | CRJ | LAND USE SUBMITAL |

Title: **PRE-DEVELOPED BASIN MAP**
BROWN BEAR CAR WASH
55 NW GILMAN BLVD.
ISSAQUAH, WA

For: CAR WASH ENTERPRISES, INC.
3977 LEARY WAY NW
SEATTLE, WASHINGTON 98107

4/3/2020

Scale: Horizontal 1" = 10' Vertical NA

Designed ADW Drawn ADW Checked AEM Approved CRJ Date 11/15/19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Job Number 20693

Sheet 1 of 1

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## 5.2 Developed Site Hydrology

Narrative

### Developed Basins

The developed basin, tributary to the site discharge location, can be broken down as follows:

Detained Basin

| Impervious | Pervious | Total Area |
|---|---|---|
| 0.303 Ac | 0.120 Ac | 0.423 Ac |

Bypass Basin

| Impervious | Pervious | Total Area |
|---|---|---|
| 0.074 Ac | 0.002 Ac | 0.076 Ac |

A detailed report on the procedures used for the sizing of the proposed combination detention and water quality pond is provided in Section 5.4 of this report.

# Figure 5.2
# Developed Basin Map

# DEVELOPED BASIN MAP

FOR

# BROWN BEAR CAR WASH

SE $\frac{1}{4}$ OF NE $\frac{1}{4}$ OF SEC. 28, TWN. 24 N, RGE. 6 E, W.M.
CITY OF ISSAQUAH, KING COUNTY, WASHINGTON

1"=10'
0 5 10 20

DETAINED BASIN AREA:

NEW AND REPLACED IMPERVIOUS/PERVIOUS AREAS

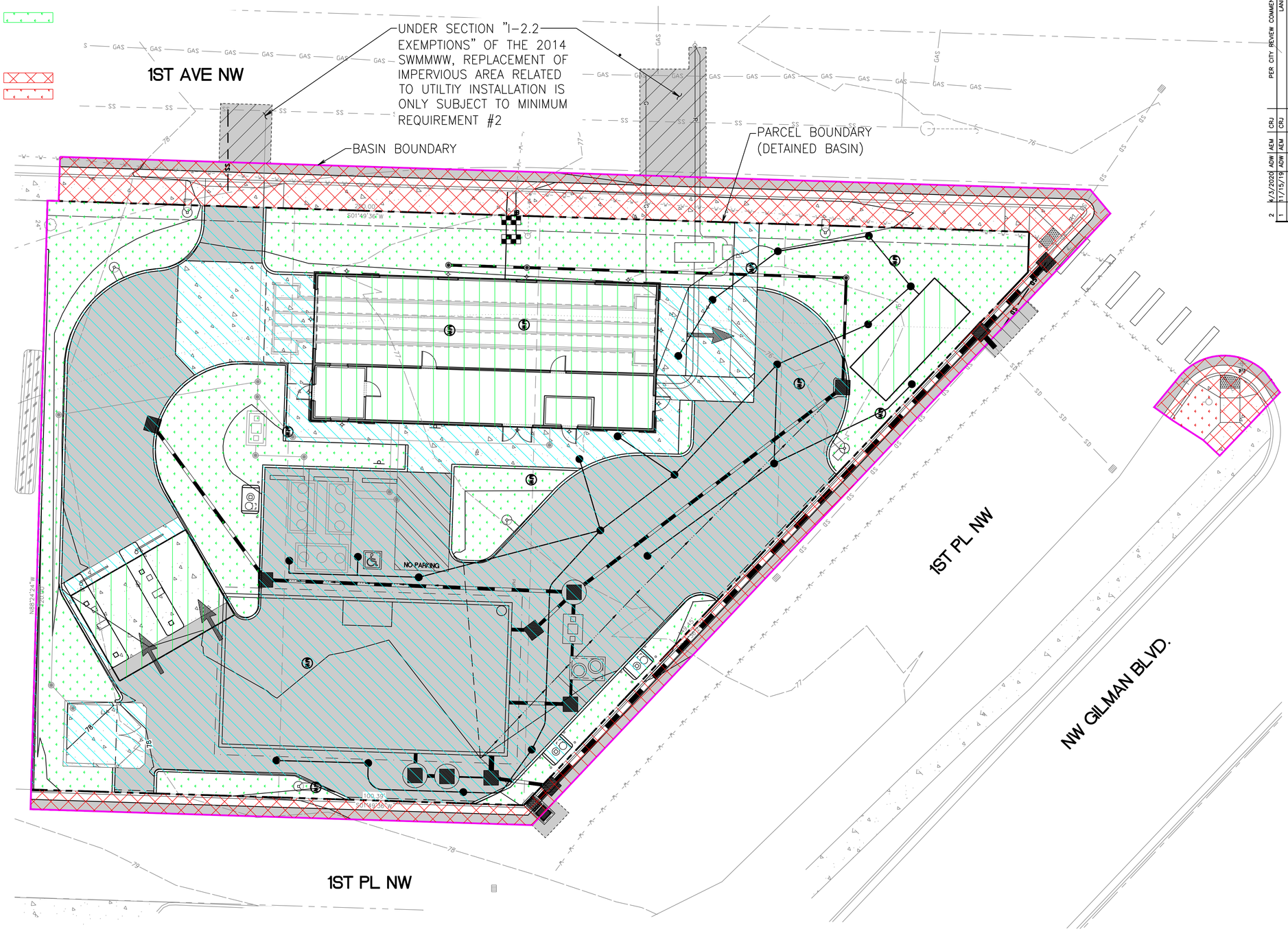
| | |
|---|---|
| BUILDINGS: | 2,890 SF (0.0663 AC) |
| DRIVING SURFACE, CONC. WALKWAYS, CURBS: | 10,294 SF (0.2363 AC) |
| **TOTAL NEW AND REPLACED IMPERVIOUS:** | **13,184 SF (0.303 AC)** |
| LANDSCAPE: | 5,247 SF (0.120 AC) |
| TOTAL DETAINED BASIN AREA: | 18,431 SF (0.423 AC) |

BYPASS BASIN AREA:

NEW AND REPLACED IMPERVIOUS AREAS (BYPASS)

| | |
|---|---|
| DRIVING SURFACE, SIDEWALKS, CURB AND GUTTER: | 3,226 SF (0.074 AC) |
| LANDSCAPE AREA (BYPASS): | 67 SF (0.002 AC) |
| TOTAL BYPASS BASIN AREA: | 3,293 SF (0.076 AC) |

TOTAL PROJECT BASIN AREA: 18,431 SF + 3,293 SF = 21,724 SF (0.499 AC)




Know what's **below.** **Call** before you dig. Dial 811

| No. | Date | By | Ckd. | Appr. | Revision |
|---|---|---|---|---|---|
| 2 | 4/3/2020 | ADW | AEM | CRJ | PER CITY REVIEW COMMENTS RECIEVED 02/19/2020 |
| 1 | 11/15/19 | ADW | AEM | CRJ | LAND USE SUBMITTAL |

Title: **DEVELOPED BASIN MAP**
BROWN BEAR CAR WASH
55 NW GILMAN BLVD.
ISSAQUAH, WA

For: CAR WASH ENTERPRISES, INC.
3977 LEARY WAY NW
SEATTLE, WASHINGTON 98107

4/3/2020

Scale: Horizontal 1" = 10' Vertical NA

Designed ADW Drawn ADW Checked AEM Approved CRJ Date 11/15/19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Sheet 1 of 1

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## 5.3 Performance Standards and Goals

This project proposes to create more than 10,000 square feet of new and replaced impervious surface within a threshold discharge area, and is located outside the City of Issaquah Alternative Flow Control Drainage Basin. This project site's existing surface contains greater than 35 percent impervious surface coverage and is therefore defined as a redevelopment project. The anticipated increase value of the site improvements will likely be greater than 50 percent of the value of existing site improvements; therefore, all new and replaced hard surfaces are considered targeted surfaces. Additionally, the pre-developed condition of the site must be modeled as forested for the purpose of flow control calculations. This project will provide flow control to "Match developed discharge durations to pre-developed duration for the range of predeveloped discharge rates from 50 percent of the 2-year peak flow up to the full 50-year peak flow" per Minimum Requirement No. 7.

Water quality treatment must also be provided per Minimum Requirement No. 6, as this project proposes greater than 5,000 square feet pollution generating hard surface. This site is a commercial project site and is an anticipated high use site, therefore Enhanced treatment must be provided. This project will propose a Bio clean Environmental MWS-Linear Modular Wetland system that will treat stormwater runoff downstream of the proposed detention facility.

Figure 5.3
Drainage Facility

for pretreatment, hydraulic profile, design treatment flow rates, flow bypass, and other criteria.

Table 1-4 lists GULD-approved technologies for pre-treatment, basic, enhance, and phosphorus treatment. This list is also contained in the Approved Materials List and will be updated periodically. Basic treatment and pre-treatment is used prior to infiltration or as part of treatment train (see design manual).

**TABLE 1-4 WATER QUALITY TREATMENT OPTIONS**

| Product | Pre-Treat | Basic | Enhanced | Phosp. |
|---|---|---|---|---|
| **EMERGING TECHNOLOGIES** | | | | |
| AquaShield Aqua-Swirl System | X | | | |
| Baysaver BayFilter® | | X | | |
| Contech CDS™ Stormwater Treatment System | X | | | |
| WSDOT Compost-Amended Biofiltration Swale | | X | X | |
| Hydro International Downstream Defender | X | | | |
| Watertechtonics ecoStorm plus | | X | | |
| Contech Filterra® Bioscape™ | | X | X | X |
| Contech Filterra® System | | X | X | X |
| Oldcastle FloGard Perk Filter® | | X | | X |
| WSDOT Media Filter Drain | | X | X | X |
| Contech Media Filtration System | | X | | |
| Bio Clean Environmental MWS-Linear Modular Wetland | | X | X | X |
| Imbrium Systems Stormceptor | X | | | |
| Contech StormFilter -PhosphoSorb Media at 1.67 gpm/sq ft | | X | | X |
| Contech Stormfilter using ZPG Media | | X | | |
| Contech Vortechs System | X | | | |
| **STORMWATER DESIGN MANUAL** | | | | |
| Infiltration (with pretreatment) | | **X** | **X** | **X** |
| Large sand filter[1] | | **X** | **X** | **X** |
| Large wet pond | | x | | x |
| Two-facility treatment train (see manual) [2] | | x | x | x |

[1]Private development only. Sand filters not accepted as a City-owned facility.

[2]Requires basic or linear sand filter as part of the treatment train, also not accepted as a City-owned facility.

Figure 5.4
Table 1-5
Requirements for
On-Site Stormwater
BMPs

| TABLE 1-5 REQUIREMENTS FOR ON-SITE STORMWATER BMPS (MR#5) | | | | |
|---|---|---|---|---|
| | | BMPs to be Evaluated for Feasibility | | |
| Surface | How Evaluated | Projects that trigger MR#1-MR#5 | Projects that Trigger MR#6-MR#9 | General Criteria[a] |
| Lawn/ Landscaped Areas | Required in all projects. | 1. Post-Construction Soil Quality and Depth (BMP T5.13; IMC 18.12.140) | | De-compact and add topsoil meeting pH and organic criteria to depth of 8 inches. |
| Roofs | Use BMPs that are determined to be feasible, evaluated in order listed, until full BMP criteria is met. | 2a. Full Dispersion (BMP T5.30), or Downspout Full Infiltration Systems (BMP T5.10A). | | Full dispersion requires large native growth area: 6.5 times area of roof draining to it.<br>Downspout infiltration requires less area but is subject to soil conditions. |
| | | 2b. Rain Gardens (BMP T5.14A), or Bioretention. | Same as MR#1-MR#5 except Bioretention in place of rain gardens. | Area of rain garden or bioretention to be 5% of roof area draining to it, at depth of 6-12 inches.<br>Bioretention adds engineering criteria on design infiltration rate. |
| | | 2c. Downspout Dispersion Systems (BMP T5.10B) | | Used if dispersion area is moderate (25-50 ft length) using splash blocks or gravel-filled trenches |
| | | 2d. Perforated Stub-out Connections (BMP T5.10C) | | Used if dispersion area is minimal (<25 ft length) using perforated pipe in 24" wide gravel trench |
| Other Hard Surfaces (e.g., parking lots, sidewalks) | Use BMPs that are determined to be feasible, evaluated in order listed, until full BMP criteria is met. | 3a. Full Dispersion (BMP T5.30) | | Full Dispersion: see #2a above. |
| | | 3b. Permeable pavement (BMP T5.15), or Rain Gardens (BMP T5.14A) | Same as MR#1-MR#5 except Bioretention in place of rain gardens. | Permeable pavement: All surfaces, except high use, roads >400 ADT, and other infeasibility criteria.<br>Rain gardens/bioretention: see #2b above. |
| | | 3c. Sheet Flow Dispersion (BMP T5.12), or Concentrated Flow Dispersion (BMP T5.11) | | Sheet flow: min 10 ft or larger vegetated buffer next to parking lot or road.<br>Concentrated flow dispersion requires 50 ft flow path and is limited to 700 sf of hard surface. |

[a] This is a generalized summary only, and does not reflect the BMP infeasibility criteria or competing needs assessment that may apply to the project and site. See BMP sheets in Ecology Manual for complete criteria.

## 5.4 Low Impact Development Features

This project triggers Minimum Requirements Nos. 1 through 9 and must either use on-site stormwater management BMPs from List No. 2, or demonstrate compliance with the LID Performance Standard and BMP T5.13. This project will choose to evaluate the feasibility of on-site stormwater management BMPs from List No. 2.

**Lawn and Landscaped Areas**

1. Soil preservation and Amendment BMP in Volume III, Section 3.1.

   **Feasible:** Post Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 Volume V of the SWMMWW will be applied to all proposed landscaping areas.

**Roofs:**

1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the SWMMWW, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 of Volume III of the SWMMWW.

   **Infeasible:** This project will not preserve 65 percent of the site area as forest or native vegetation. Additionally, infiltration is infeasible for this project due to the project being located within a CARA Class 1, and wellhead protection zone.

2. Bioretention (See Chapter 7 of Volume V of the SWMMWW) facilities that have a minimum horizontally projected surface area below the overflow, which is at least 5 percent of the total surface area draining to it.

   **Infeasible:** Bioretention is infeasible due to the infeasibility of on-site infiltration. The site is located within a CARA Class 1, and a wellhead protection Zone.

3. Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2, Volume III, of the SWMMWW.

   **Infeasible:** Downspout dispersion systems are infeasible due to the lack of available vegetated area and flow path space.

4. Perforated Stub-out Connections in accordance with BMP T5.10C in Section 3.1.3, Volume III, of the SWMMWW.

   **Infeasible:** Perforated Stub-out Connections are infeasible. All rooftop runoff is proposed to be collected and discharge to a stormwater detention facility designed to meet Minimum Requirement No. 7 of Flow Control Requirements.

**Other Hard Surfaces:**

1. Full Dispersion in accordance with BMP T5.30 in Chapter, Volume V, of the SWMMWW.

   **Infeasible:** This project will not preserve 65 percent of the site area as forest or native vegetation.

2. Permeable Pavement No. 2 is in accordance with BMP T5.15 in Chapter 5, Volume V, of the SWMMWW.

**Infeasible:** This site is defined as high use, and therefore does not require the evaluation of permeable pavement. Additionally, this site is not allowed to use infiltration BMPs as it is located within a CARA.

3. Bioretention (See Chapter 7, Volume V of the SWMMWW) facilities that have a minimum horizontally projected surface area below the overflow which is at least 5 percent of the total surface area draining to it.

   **Infeasible:** Bioretention is infeasible due to the infeasibility of on-site infiltration. The site is located within a CARA Class 1, and wellhead protection Zone.

4. Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5, Volume V, of the SWMMWW.

   **Infeasible:** The site lacks the available vegetated flow path space for sheet flow dispersion per BMP T5.12, or concentrated flow dispersion per BMP T5.11.

## 5.5 Flow Control System

This site proposes greater than 10,000 square feet of new and replaced impervious surface and will provide flow control such that "Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50 percent of the 2-year peak flow up to the full 50-year peak flow."

The site is located within a CARA Class 1 and is not allowed to infiltrate stormwater runoff. A detention vault has been proposed to meet the required flow control standard.

The proposed stormwater detention vault has been sized using WWHM2012.

The pre-developed condition has been modeled as a forested land cover.

The developed condition models all proposed rooftop areas, and other hard surfaces that will drain to the detention facility. Proposed pervious areas will implement BMP T5.13: Post Construction Soil Quality and Depth have been modeled as pasture as allowed by SWMMWW Volume III Appendix C.

### Bypass Area

Improvements within the public right-of-way will bypass the detention system, as they cannot be feasibly isolated from the surrounding street surfaces, and collected. WWHM2012 calculation indicate that flow rate durations of the bypass area alone closely match the pre-developed flow rate durations for the entire site.; therefore, it will not be possible or feasible to design a detention system that will meet the flow control standard if the bypass area is modeled as un-detained runoff. Per the 2014 DOE SWMMWW, Volume III – Appendix B, the following conditions for the bypass area must be met:

1. *Runoff from both the bypass area and the flow control facility converges within a quarter-mile downstream of the project site discharge point.*

   **Response:** Runoff from the detained area will discharge to stormwater conveyance that collects runoff from the bypass areas immediately adjacent to the site. The location of convergence is approximately 40 feet downstream of the project site.

2. *The flow control facility is designed to compensate for the uncontrolled bypass area such that the net effect at the point of convergence downstream is the same with or without bypass.*

   **Response:** The flow control facility has been sized to compensate for the uncontrolled bypass area. The detention vault is sized to accept runoff from an area equivalent to the bypass area while meeting the flow control standard. Therefore, the net effect of this compensation will allow the site to meet the flow control duration standard weather the site is modeled with or without the bypass area.

3. *The 100-year peak discharge from the bypass area will not exceed 0.4 cfs*

   Response: The 100-Year peak discharge rate from the bypass area does not exceed 0.4 cfs. WWHM2012 calculations of the bypass area flow frequency rates are included in this report.

4. *Runoff from the bypass area will not create a significant adverse impact to downstream drainage systems or properties.*

   **Response:** The existing conditions of the bypass area consist of an almost entirely impervious area. Runoff characteristics within the bypass area will remain relatively

unchanged with the proposed developments, and therefore it is anticipated that the bypass area will not create an observable adverse impact to downstream drainage systems or properties.

5. *Water quality requirements applicable to the bypass area are met.*

   **Response:** The pollution generating hard surface area of the bypass area is approximately 1,036 square feet. Due to site constrains, treatment of an area greater than or equal to the proposed pollution generating hard surfaces within the ROW is proposed to be achieved with a Contech Stormfilter Concrete Catch Basin.

**Pump Design**

Due to the shallow depth of the downstream conveyance system, this project will require a pump system to be placed downstream of the flow control facility. The pump system has been designed to activate when water within the pump basin reaches a depth equal to IE of the pump basin's inlet pipe, and provides a discharge rate greater than or equal to the anticipated 100-year mitigated flow rate to ensure the prevention of a backwater condition within the vault, and water quality facilities. This will also ensure that gravity flow is maintained between the outlet of the vault and the pump basin. By maintaining gravity flow between the detention facility and the pump basin, the hydraulic residence time of on-site runoff within the detention vault remains equivalent between the proposed pump system, and a system that would depend entirely on gravity flows; therefore, the quantity of stormwater discharge during the pump activation timeframe will be equivalent to the quantity of stormwater discharged through a gravity system during the full pump cycle timeframe.

# Figure 5.5
# Table 1-1 Project Screening for Stormwater Review

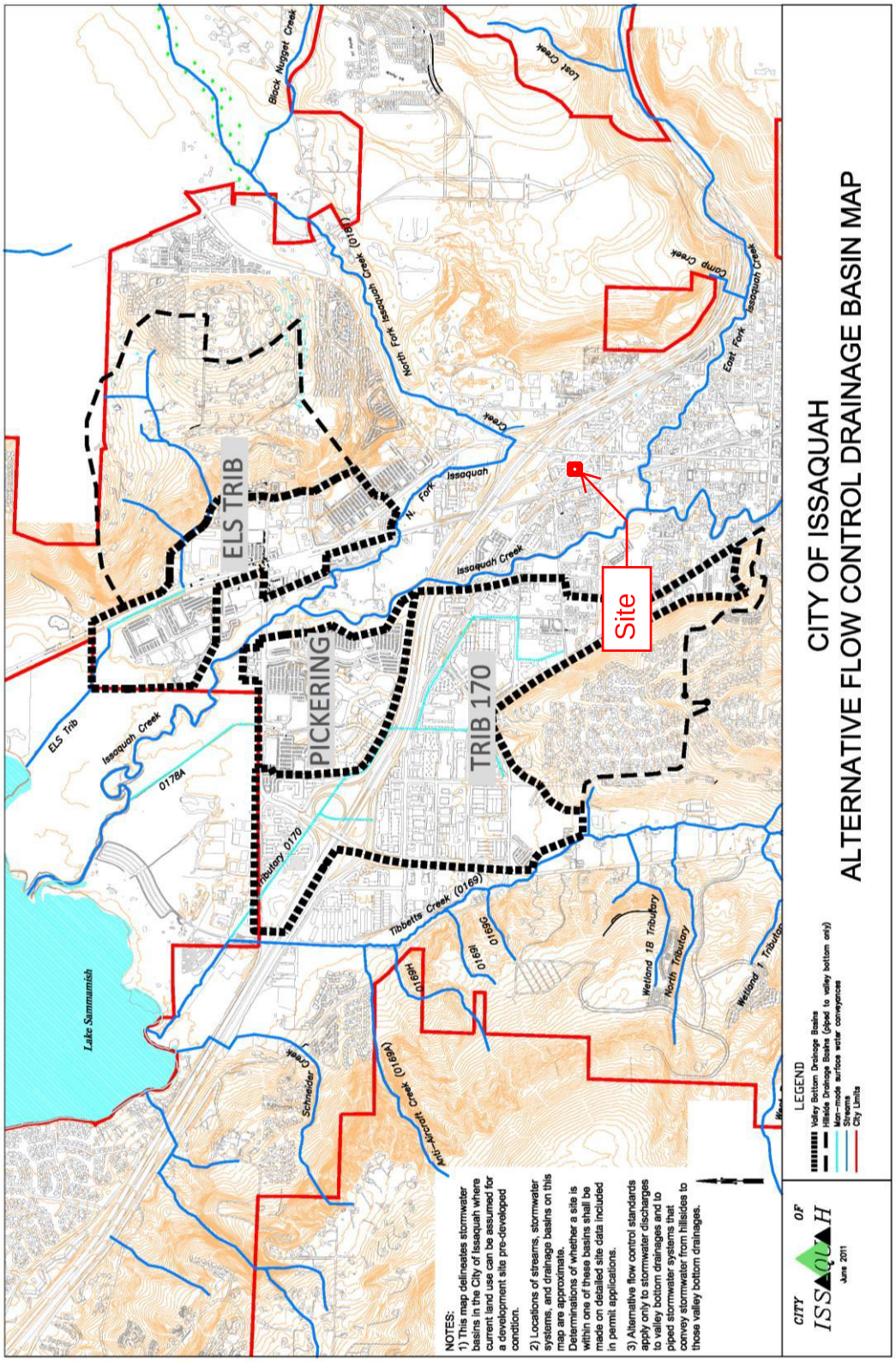
**Table 1-1 PROJECT SCREENING FOR STORMWATER REVIEW**

| Project Type[b] | Screening Thresholds[a] | | | Minimum Requirements[a] | | | |
|---|---|---|---|---|---|---|---|
| | Hard Surfaces | | Land Clearing | MR #1-5 | MR #6-9 | Stormwater Facility Target Surfaces[d] | Pre-Dev Cond. |
| **1. TESC Only** | <2000 SF new plus replaced hard surfaces | or | <7000 SF land disturbance | MR #2 – Construction Stormwater Pollution Prevention Plan | | | |
| **2. New Development** – *All projects*[c] | 2000-5000 SF new plus replaced hard surfaces | or | 7000-32,670 SF land disturbance | ✓ | | -- | -- |
| | >5000 SF new plus replaced hard surfaces | or | >32,670 SF land disturbance | ✓ | ✓ | New and replaced hard surfaces | Forested |
| **3a. Redevelopment** - *Value of proposed improvements is <50% of value of existing site improvements*[c] | 2000-5000 SF new plus replaced hard surfaces | or | 7000-32,670 SF land disturbance | ✓ | | -- | -- |
| | >5000 SF new plus replaced hard surfaces | or | >32,670 SF land disturbance | ✓ | ✓ | New hard surfaces only | Forested |
| **3b. Redevelopment** - *Value of proposed improvements is >50% of value of existing site improvements*[c] | 2000-5000 SF new plus replaced hard surfaces | or | 7000-32,670 SF land disturbance | ✓ | | -- | -- |
| | >5000 SF new plus replaced hard surfaces | or | >32,670 SF land disturbance | ✓ | ✓ | New and replaced hard surfaces | Forested |
| **4a. Transportation redevelopment** - *New hard surfaces add <50% to existing hard surfaces* | 2000-5000 SF new plus replaced hard surfaces | or | 7000-32,670 SF land disturbance | ✓ | | -- | -- |
| | >5000 SF new plus replaced hard surfaces | or | >32,670 SF land disturbance | ✓ | ✓ | New hard surfaces only | Forested |
| **4b. Transportation redevelopment** - *New hard surfaces add >50% to existing hard surfaces* | 2000-5000 SF new plus replaced hard surfaces | or | 7000-32,670 SF land disturbance | ✓ | | -- | -- |
| | >5000 SF new plus replaced hard surfaces | or | >32,670 SF land disturbance | ✓ | ✓ | New and replaced hard surfaces | Forested |
| **5. Central Issaquah Alternative Flow Control Area (see Figure 2-5)** – *All projects* | 2000-5000 SF new plus replaced hard surfaces | or | 7000-32,670 SF land disturbance | ✓ | | -- | -- |
| | >5000 SF new plus replaced hard surfaces | or | >32,670 SF land disturbance | ✓ | ✓ | New hard surfaces only | Existing |

[a]See Chapter 2 for requirements, following the flow charts in Figures 2-4 and 2-4 and referring to Minimum Requirements for specific criteria.
[b]See Chapter 2.1 for additional exemptions.
[c]New Development are sites with <35% existing impervious coverage; Redevelopment are sites with >35% existing impervious coverage.
[d]Stormwater Facility Target Surfaces: for flow control and water quality treatment. Onsite Stormwater BMPs required under MR #5.

# Figure 5.6
# Central Issaquah Area
# Altrenative Flow
# Control Standard Map

**Figure 2-5. Central Issaquah Area Alternative Flow Control Standard Map**



# Figure 5.7
# Detention Sizing Calculations

# WWHM2012

# PROJECT REPORT

# General Model Information

| | |
|---|---|
| Project Name: | 20693-Detention 2020-4-1 |
| Site Name: | Brown Bear Car Wash |
| Site Address: | 55 NW Gilman BLVD |
| City: | Issaquah, WA |
| Report Date: | 4/1/2020 |
| Gage: | Seatac |
| Data Start: | 1948/10/01 |
| Data End: | 2009/09/30 |
| Timestep: | 15 Minute |
| Precip Scale: | 1.333 |
| Version Date: | 2019/09/13 |
| Version: | 4.2.17 |

## POC Thresholds

| | |
|---|---|
| Low Flow Threshold for POC1: | 50 Percent of the 2 Year |
| High Flow Threshold for POC1: | 50 Year |

# *Landuse Basin Data*

## *Predeveloped Land Use*

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Forest, Flat | 0.499 |
| Pervious Total | 0.499 |
| Impervious Land Use | acre |
| Impervious Total | 0 |
| Basin Total | 0.499 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## *Mitigated Land Use*

### Basin 1

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| C, Pasture, Flat | 0.122 |
| Pervious Total | 0.122 |

| Impervious Land Use | acre |
|---|---|
| ROADS FLAT | 0.311 |
| ROOF TOPS FLAT | 0.066 |
| Impervious Total | 0.377 |
| Basin Total | 0.499 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Vault 1 | Vault 1 | |

# Routing Elements
## Predeveloped Routing

## *Mitigated Routing*

### Vault 1

Width: 41.5 ft.
Length: 41.5 ft.
Depth: 7 ft.
Discharge Structure
Riser Height: 6 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.45 in. Elevation:0 ft.
Orifice 2 Diameter: 0.8 in. Elevation:4.002 ft.
Orifice 3 Diameter: 0.59 in. Elevation:5.03375 ft.
Element Flows To:
Outlet 1 Outlet 2

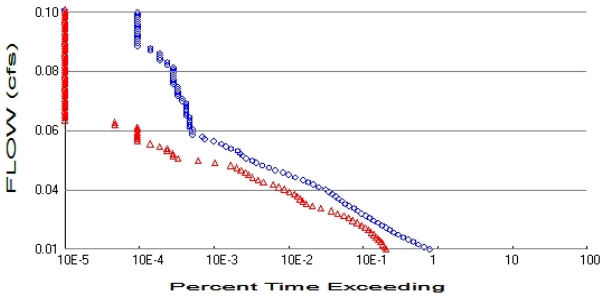
Vault Hydraulic Table

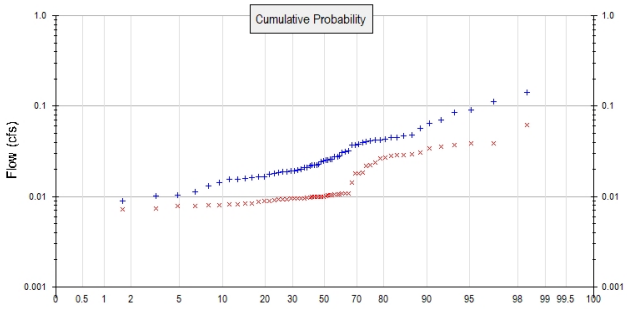
| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.039 | 0.000 | 0.000 | 0.000 |
| 0.0778 | 0.039 | 0.003 | 0.001 | 0.000 |
| 0.1556 | 0.039 | 0.006 | 0.002 | 0.000 |
| 0.2333 | 0.039 | 0.009 | 0.002 | 0.000 |
| 0.3111 | 0.039 | 0.012 | 0.003 | 0.000 |
| 0.3889 | 0.039 | 0.015 | 0.003 | 0.000 |
| 0.4667 | 0.039 | 0.018 | 0.003 | 0.000 |
| 0.5444 | 0.039 | 0.021 | 0.004 | 0.000 |
| 0.6222 | 0.039 | 0.024 | 0.004 | 0.000 |
| 0.7000 | 0.039 | 0.027 | 0.004 | 0.000 |
| 0.7778 | 0.039 | 0.030 | 0.004 | 0.000 |
| 0.8556 | 0.039 | 0.033 | 0.005 | 0.000 |
| 0.9333 | 0.039 | 0.036 | 0.005 | 0.000 |
| 1.0111 | 0.039 | 0.040 | 0.005 | 0.000 |
| 1.0889 | 0.039 | 0.043 | 0.005 | 0.000 |
| 1.1667 | 0.039 | 0.046 | 0.005 | 0.000 |
| 1.2444 | 0.039 | 0.049 | 0.006 | 0.000 |
| 1.3222 | 0.039 | 0.052 | 0.006 | 0.000 |
| 1.4000 | 0.039 | 0.055 | 0.006 | 0.000 |
| 1.4778 | 0.039 | 0.058 | 0.006 | 0.000 |
| 1.5556 | 0.039 | 0.061 | 0.006 | 0.000 |
| 1.6333 | 0.039 | 0.064 | 0.007 | 0.000 |
| 1.7111 | 0.039 | 0.067 | 0.007 | 0.000 |
| 1.7889 | 0.039 | 0.070 | 0.007 | 0.000 |
| 1.8667 | 0.039 | 0.073 | 0.007 | 0.000 |
| 1.9444 | 0.039 | 0.076 | 0.007 | 0.000 |
| 2.0222 | 0.039 | 0.080 | 0.007 | 0.000 |
| 2.1000 | 0.039 | 0.083 | 0.008 | 0.000 |
| 2.1778 | 0.039 | 0.086 | 0.008 | 0.000 |
| 2.2556 | 0.039 | 0.089 | 0.008 | 0.000 |
| 2.3333 | 0.039 | 0.092 | 0.008 | 0.000 |
| 2.4111 | 0.039 | 0.095 | 0.008 | 0.000 |
| 2.4889 | 0.039 | 0.098 | 0.008 | 0.000 |
| 2.5667 | 0.039 | 0.101 | 0.008 | 0.000 |
| 2.6444 | 0.039 | 0.104 | 0.008 | 0.000 |
| 2.7222 | 0.039 | 0.107 | 0.009 | 0.000 |
| 2.8000 | 0.039 | 0.110 | 0.009 | 0.000 |
| 2.8778 | 0.039 | 0.113 | 0.009 | 0.000 |

| | | | | |
|---|---|---|---|---|
| 2.9556 | 0.039 | 0.116 | 0.009 | 0.000 |
| 3.0333 | 0.039 | 0.119 | 0.009 | 0.000 |
| 3.1111 | 0.039 | 0.123 | 0.009 | 0.000 |
| 3.1889 | 0.039 | 0.126 | 0.009 | 0.000 |
| 3.2667 | 0.039 | 0.129 | 0.009 | 0.000 |
| 3.3444 | 0.039 | 0.132 | 0.010 | 0.000 |
| 3.4222 | 0.039 | 0.135 | 0.010 | 0.000 |
| 3.5000 | 0.039 | 0.138 | 0.010 | 0.000 |
| 3.5778 | 0.039 | 0.141 | 0.010 | 0.000 |
| 3.6556 | 0.039 | 0.144 | 0.010 | 0.000 |
| 3.7333 | 0.039 | 0.147 | 0.010 | 0.000 |
| 3.8111 | 0.039 | 0.150 | 0.010 | 0.000 |
| 3.8889 | 0.039 | 0.153 | 0.010 | 0.000 |
| 3.9667 | 0.039 | 0.156 | 0.010 | 0.000 |
| 4.0444 | 0.039 | 0.159 | 0.014 | 0.000 |
| 4.1222 | 0.039 | 0.163 | 0.017 | 0.000 |
| 4.2000 | 0.039 | 0.166 | 0.019 | 0.000 |
| 4.2778 | 0.039 | 0.169 | 0.020 | 0.000 |
| 4.3556 | 0.039 | 0.172 | 0.021 | 0.000 |
| 4.4333 | 0.039 | 0.175 | 0.023 | 0.000 |
| 4.5111 | 0.039 | 0.178 | 0.024 | 0.000 |
| 4.5889 | 0.039 | 0.181 | 0.025 | 0.000 |
| 4.6667 | 0.039 | 0.184 | 0.026 | 0.000 |
| 4.7444 | 0.039 | 0.187 | 0.026 | 0.000 |
| 4.8222 | 0.039 | 0.190 | 0.027 | 0.000 |
| 4.9000 | 0.039 | 0.193 | 0.028 | 0.000 |
| 4.9778 | 0.039 | 0.196 | 0.029 | 0.000 |
| 5.0556 | 0.039 | 0.199 | 0.031 | 0.000 |
| 5.1333 | 0.039 | 0.203 | 0.033 | 0.000 |
| 5.2111 | 0.039 | 0.206 | 0.035 | 0.000 |
| 5.2889 | 0.039 | 0.209 | 0.037 | 0.000 |
| 5.3667 | 0.039 | 0.212 | 0.038 | 0.000 |
| 5.4444 | 0.039 | 0.215 | 0.039 | 0.000 |
| 5.5222 | 0.039 | 0.218 | 0.040 | 0.000 |
| 5.6000 | 0.039 | 0.221 | 0.042 | 0.000 |
| 5.6778 | 0.039 | 0.224 | 0.043 | 0.000 |
| 5.7556 | 0.039 | 0.227 | 0.044 | 0.000 |
| 5.8333 | 0.039 | 0.230 | 0.045 | 0.000 |
| 5.9111 | 0.039 | 0.233 | 0.046 | 0.000 |
| 5.9889 | 0.039 | 0.236 | 0.047 | 0.000 |
| 6.0667 | 0.039 | 0.239 | 0.321 | 0.000 |
| 6.1444 | 0.039 | 0.242 | 0.918 | 0.000 |
| 6.2222 | 0.039 | 0.246 | 1.686 | 0.000 |
| 6.3000 | 0.039 | 0.249 | 2.552 | 0.000 |
| 6.3778 | 0.039 | 0.252 | 3.437 | 0.000 |
| 6.4556 | 0.039 | 0.255 | 4.268 | 0.000 |
| 6.5333 | 0.039 | 0.258 | 4.977 | 0.000 |
| 6.6111 | 0.039 | 0.261 | 5.522 | 0.000 |
| 6.6889 | 0.039 | 0.264 | 5.903 | 0.000 |
| 6.7667 | 0.039 | 0.267 | 6.260 | 0.000 |
| 6.8444 | 0.039 | 0.270 | 6.568 | 0.000 |
| 6.9222 | 0.039 | 0.273 | 6.862 | 0.000 |
| 7.0000 | 0.039 | 0.276 | 7.144 | 0.000 |
| 7.0778 | 0.039 | 0.279 | 7.415 | 0.000 |
| 7.1556 | 0.000 | 0.000 | 7.677 | 0.000 |

# Analysis Results

## POC 1




\+ Predeveloped  x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.499
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.122
Total Impervious Area: 0.377

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.02584 |
| 5 year | 0.044242 |
| 10 year | 0.059653 |
| 25 year | 0.083179 |
| 50 year | 0.103896 |
| 100 year | 0.127561 |

Flow Frequency Return Periods for Mitigated. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.012515 |
| 5 year | 0.020665 |
| 10 year | 0.027759 |
| 25 year | 0.039021 |
| 50 year | 0.049334 |
| 100 year | 0.061525 |

## Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

| **Year** | **Predeveloped** | **Mitigated** |
|---|---|---|
| 1949 | 0.037 | 0.009 |
| 1950 | 0.042 | 0.011 |
| 1951 | 0.048 | 0.039 |
| 1952 | 0.016 | 0.008 |
| 1953 | 0.014 | 0.010 |
| 1954 | 0.020 | 0.009 |
| 1955 | 0.031 | 0.009 |
| 1956 | 0.028 | 0.022 |
| 1957 | 0.025 | 0.009 |
| 1958 | 0.023 | 0.010 |

| | | |
|---|---|---|
| 1959 | 0.019 | 0.009 |
| 1960 | 0.042 | 0.028 |
| 1961 | 0.019 | 0.011 |
| 1962 | 0.013 | 0.008 |
| 1963 | 0.019 | 0.010 |
| 1964 | 0.025 | 0.011 |
| 1965 | 0.021 | 0.018 |
| 1966 | 0.016 | 0.010 |
| 1967 | 0.043 | 0.010 |
| 1968 | 0.022 | 0.010 |
| 1969 | 0.022 | 0.009 |
| 1970 | 0.019 | 0.010 |
| 1971 | 0.026 | 0.010 |
| 1972 | 0.037 | 0.030 |
| 1973 | 0.018 | 0.018 |
| 1974 | 0.024 | 0.010 |
| 1975 | 0.032 | 0.009 |
| 1976 | 0.022 | 0.010 |
| 1977 | 0.015 | 0.008 |
| 1978 | 0.018 | 0.010 |
| 1979 | 0.011 | 0.007 |
| 1980 | 0.070 | 0.031 |
| 1981 | 0.016 | 0.010 |
| 1982 | 0.045 | 0.023 |
| 1983 | 0.026 | 0.010 |
| 1984 | 0.016 | 0.008 |
| 1985 | 0.010 | 0.008 |
| 1986 | 0.040 | 0.011 |
| 1987 | 0.038 | 0.026 |
| 1988 | 0.017 | 0.009 |
| 1989 | 0.010 | 0.008 |
| 1990 | 0.141 | 0.029 |
| 1991 | 0.057 | 0.027 |
| 1992 | 0.021 | 0.010 |
| 1993 | 0.019 | 0.008 |
| 1994 | 0.009 | 0.007 |
| 1995 | 0.025 | 0.011 |
| 1996 | 0.064 | 0.037 |
| 1997 | 0.046 | 0.036 |
| 1998 | 0.022 | 0.008 |
| 1999 | 0.085 | 0.028 |
| 2000 | 0.018 | 0.010 |
| 2001 | 0.006 | 0.007 |
| 2002 | 0.032 | 0.014 |
| 2003 | 0.043 | 0.009 |
| 2004 | 0.045 | 0.038 |
| 2005 | 0.028 | 0.010 |
| 2006 | 0.028 | 0.022 |
| 2007 | 0.113 | 0.062 |
| 2008 | 0.091 | 0.034 |
| 2009 | 0.040 | 0.018 |

## Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

| Rank | Predeveloped | Mitigated |
|---|---|---|
| 1 | 0.1408 | 0.0624 |
| 2 | 0.1127 | 0.0391 |
| 3 | 0.0908 | 0.0384 |

| | | |
|---|---|---|
| 4 | 0.0852 | 0.0369 |
| 5 | 0.0699 | 0.0356 |
| 6 | 0.0641 | 0.0344 |
| 7 | 0.0570 | 0.0308 |
| 8 | 0.0478 | 0.0295 |
| 9 | 0.0465 | 0.0286 |
| 10 | 0.0451 | 0.0285 |
| 11 | 0.0445 | 0.0279 |
| 12 | 0.0427 | 0.0272 |
| 13 | 0.0426 | 0.0262 |
| 14 | 0.0420 | 0.0235 |
| 15 | 0.0417 | 0.0222 |
| 16 | 0.0401 | 0.0220 |
| 17 | 0.0397 | 0.0185 |
| 18 | 0.0383 | 0.0181 |
| 19 | 0.0375 | 0.0179 |
| 20 | 0.0375 | 0.0143 |
| 21 | 0.0322 | 0.0109 |
| 22 | 0.0315 | 0.0109 |
| 23 | 0.0310 | 0.0107 |
| 24 | 0.0279 | 0.0106 |
| 25 | 0.0276 | 0.0105 |
| 26 | 0.0275 | 0.0105 |
| 27 | 0.0261 | 0.0104 |
| 28 | 0.0259 | 0.0104 |
| 29 | 0.0254 | 0.0104 |
| 30 | 0.0252 | 0.0102 |
| 31 | 0.0250 | 0.0100 |
| 32 | 0.0241 | 0.0100 |
| 33 | 0.0229 | 0.0100 |
| 34 | 0.0224 | 0.0099 |
| 35 | 0.0224 | 0.0099 |
| 36 | 0.0222 | 0.0098 |
| 37 | 0.0216 | 0.0097 |
| 38 | 0.0210 | 0.0096 |
| 39 | 0.0209 | 0.0096 |
| 40 | 0.0201 | 0.0096 |
| 41 | 0.0195 | 0.0095 |
| 42 | 0.0192 | 0.0095 |
| 43 | 0.0190 | 0.0095 |
| 44 | 0.0189 | 0.0093 |
| 45 | 0.0188 | 0.0093 |
| 46 | 0.0182 | 0.0092 |
| 47 | 0.0181 | 0.0090 |
| 48 | 0.0176 | 0.0089 |
| 49 | 0.0165 | 0.0088 |
| 50 | 0.0164 | 0.0088 |
| 51 | 0.0163 | 0.0084 |
| 52 | 0.0158 | 0.0083 |
| 53 | 0.0155 | 0.0082 |
| 54 | 0.0155 | 0.0082 |
| 55 | 0.0142 | 0.0081 |
| 56 | 0.0132 | 0.0080 |
| 57 | 0.0113 | 0.0079 |
| 58 | 0.0104 | 0.0079 |
| 59 | 0.0100 | 0.0074 |
| 60 | 0.0090 | 0.0073 |
| 61 | 0.0058 | 0.0069 |

## Duration Flows

The Facility PASSED

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0129 | 16358 | 4327 | 26 | Pass |
| 0.0138 | 13956 | 4122 | 29 | Pass |
| 0.0148 | 11777 | 3925 | 33 | Pass |
| 0.0157 | 9989 | 3664 | 36 | Pass |
| 0.0166 | 8470 | 3416 | 40 | Pass |
| 0.0175 | 7328 | 3183 | 43 | Pass |
| 0.0184 | 6297 | 2937 | 46 | Pass |
| 0.0194 | 5461 | 2723 | 49 | Pass |
| 0.0203 | 4836 | 2494 | 51 | Pass |
| 0.0212 | 4278 | 2276 | 53 | Pass |
| 0.0221 | 3809 | 2023 | 53 | Pass |
| 0.0230 | 3343 | 1783 | 53 | Pass |
| 0.0239 | 2947 | 1547 | 52 | Pass |
| 0.0249 | 2592 | 1358 | 52 | Pass |
| 0.0258 | 2284 | 1169 | 51 | Pass |
| 0.0267 | 2016 | 962 | 47 | Pass |
| 0.0276 | 1807 | 792 | 43 | Pass |
| 0.0285 | 1604 | 579 | 36 | Pass |
| 0.0295 | 1379 | 440 | 31 | Pass |
| 0.0304 | 1222 | 368 | 30 | Pass |
| 0.0313 | 1110 | 332 | 29 | Pass |
| 0.0322 | 1004 | 305 | 30 | Pass |
| 0.0331 | 911 | 280 | 30 | Pass |
| 0.0341 | 814 | 253 | 31 | Pass |
| 0.0350 | 730 | 219 | 30 | Pass |
| 0.0359 | 659 | 187 | 28 | Pass |
| 0.0368 | 542 | 159 | 29 | Pass |
| 0.0377 | 450 | 132 | 29 | Pass |
| 0.0387 | 389 | 98 | 25 | Pass |
| 0.0396 | 332 | 83 | 25 | Pass |
| 0.0405 | 260 | 70 | 26 | Pass |
| 0.0414 | 215 | 62 | 28 | Pass |
| 0.0423 | 177 | 56 | 31 | Pass |
| 0.0432 | 141 | 49 | 34 | Pass |
| 0.0442 | 116 | 43 | 37 | Pass |
| 0.0451 | 94 | 36 | 38 | Pass |
| 0.0460 | 79 | 22 | 27 | Pass |
| 0.0469 | 69 | 13 | 18 | Pass |
| 0.0478 | 57 | 7 | 12 | Pass |
| 0.0488 | 52 | 6 | 11 | Pass |
| 0.0497 | 48 | 6 | 12 | Pass |
| 0.0506 | 44 | 5 | 11 | Pass |
| 0.0515 | 36 | 5 | 13 | Pass |
| 0.0524 | 31 | 4 | 12 | Pass |
| 0.0534 | 27 | 3 | 11 | Pass |
| 0.0543 | 21 | 2 | 9 | Pass |
| 0.0552 | 16 | 2 | 12 | Pass |
| 0.0561 | 15 | 2 | 13 | Pass |
| 0.0570 | 11 | 2 | 18 | Pass |
| 0.0579 | 11 | 2 | 18 | Pass |
| 0.0589 | 11 | 2 | 18 | Pass |
| 0.0598 | 10 | 2 | 20 | Pass |
| 0.0607 | 10 | 1 | 10 | Pass |

| | | | | |
|---|---|---|---|---|
| 0.0616 | 10 | 1 | 10 | Pass |
| 0.0625 | 10 | 0 | 0 | Pass |
| 0.0635 | 10 | 0 | 0 | Pass |
| 0.0644 | 9 | 0 | 0 | Pass |
| 0.0653 | 9 | 0 | 0 | Pass |
| 0.0662 | 9 | 0 | 0 | Pass |
| 0.0671 | 9 | 0 | 0 | Pass |
| 0.0681 | 9 | 0 | 0 | Pass |
| 0.0690 | 9 | 0 | 0 | Pass |
| 0.0699 | 8 | 0 | 0 | Pass |
| 0.0708 | 8 | 0 | 0 | Pass |
| 0.0717 | 7 | 0 | 0 | Pass |
| 0.0727 | 7 | 0 | 0 | Pass |
| 0.0736 | 7 | 0 | 0 | Pass |
| 0.0745 | 7 | 0 | 0 | Pass |
| 0.0754 | 7 | 0 | 0 | Pass |
| 0.0763 | 6 | 0 | 0 | Pass |
| 0.0772 | 6 | 0 | 0 | Pass |
| 0.0782 | 6 | 0 | 0 | Pass |
| 0.0791 | 6 | 0 | 0 | Pass |
| 0.0800 | 6 | 0 | 0 | Pass |
| 0.0809 | 6 | 0 | 0 | Pass |
| 0.0818 | 6 | 0 | 0 | Pass |
| 0.0828 | 6 | 0 | 0 | Pass |
| 0.0837 | 5 | 0 | 0 | Pass |
| 0.0846 | 5 | 0 | 0 | Pass |
| 0.0855 | 4 | 0 | 0 | Pass |
| 0.0864 | 4 | 0 | 0 | Pass |
| 0.0874 | 4 | 0 | 0 | Pass |
| 0.0883 | 4 | 0 | 0 | Pass |
| 0.0892 | 3 | 0 | 0 | Pass |
| 0.0901 | 3 | 0 | 0 | Pass |
| 0.0910 | 2 | 0 | 0 | Pass |
| 0.0919 | 2 | 0 | 0 | Pass |
| 0.0929 | 2 | 0 | 0 | Pass |
| 0.0938 | 2 | 0 | 0 | Pass |
| 0.0947 | 2 | 0 | 0 | Pass |
| 0.0956 | 2 | 0 | 0 | Pass |
| 0.0965 | 2 | 0 | 0 | Pass |
| 0.0975 | 2 | 0 | 0 | Pass |
| 0.0984 | 2 | 0 | 0 | Pass |
| 0.0993 | 2 | 0 | 0 | Pass |
| 0.1002 | 2 | 0 | 0 | Pass |
| 0.1011 | 2 | 0 | 0 | Pass |
| 0.1021 | 2 | 0 | 0 | Pass |
| 0.1030 | 2 | 0 | 0 | Pass |
| 0.1039 | 2 | 0 | 0 | Pass |

## Water Quality

Water Quality BMP Flow and Volume for POC #1

| | |
|---|---|
| On-line facility volume: | 0 acre-feet |
| On-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |
| Off-line facility target flow: | 0 cfs. |
| Adjusted for 15 min: | 0 cfs. |

# LID Report

| LID Technique | Used for Treatment ? | Total Volume Needs Treatment (ac-ft) | Volume Through Facility (ac-ft) | Infiltration Volume (ac-ft) | Cumulative Volume Infiltration Credit | Percent Volume Infiltrated | Water Quality | Percent Water Quality Treated | Comment |
|---|---|---|---|---|---|---|---|---|---|
| Vault 1 POC | ☐ | 86.37 | | | ☐ | 0.00 | | | |
| Total Volume Infiltrated | | 86.37 | 0.00 | 0.00 | | 0.00 | 0.00 | 0% | No Treat. Credit |
| Compliance with LID Standard 8% of 2-yr to 50% of 2-yr | | | | | | | | | Duration Analysis Result = Failed |
| | | | | | | | | | |

# Model Default Modifications

Total of 0 changes have been made.

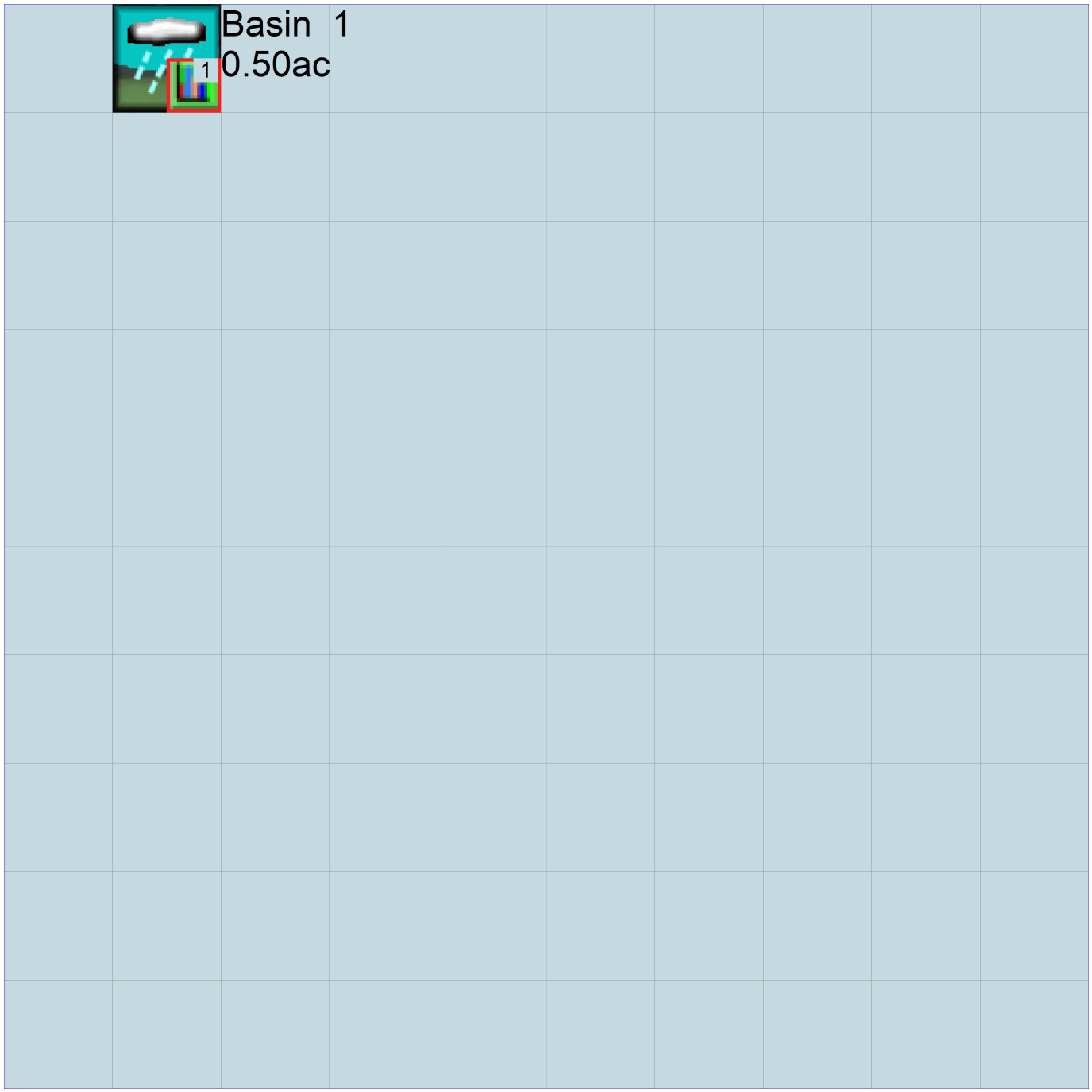
## PERLND Changes

No PERLND changes have been made.

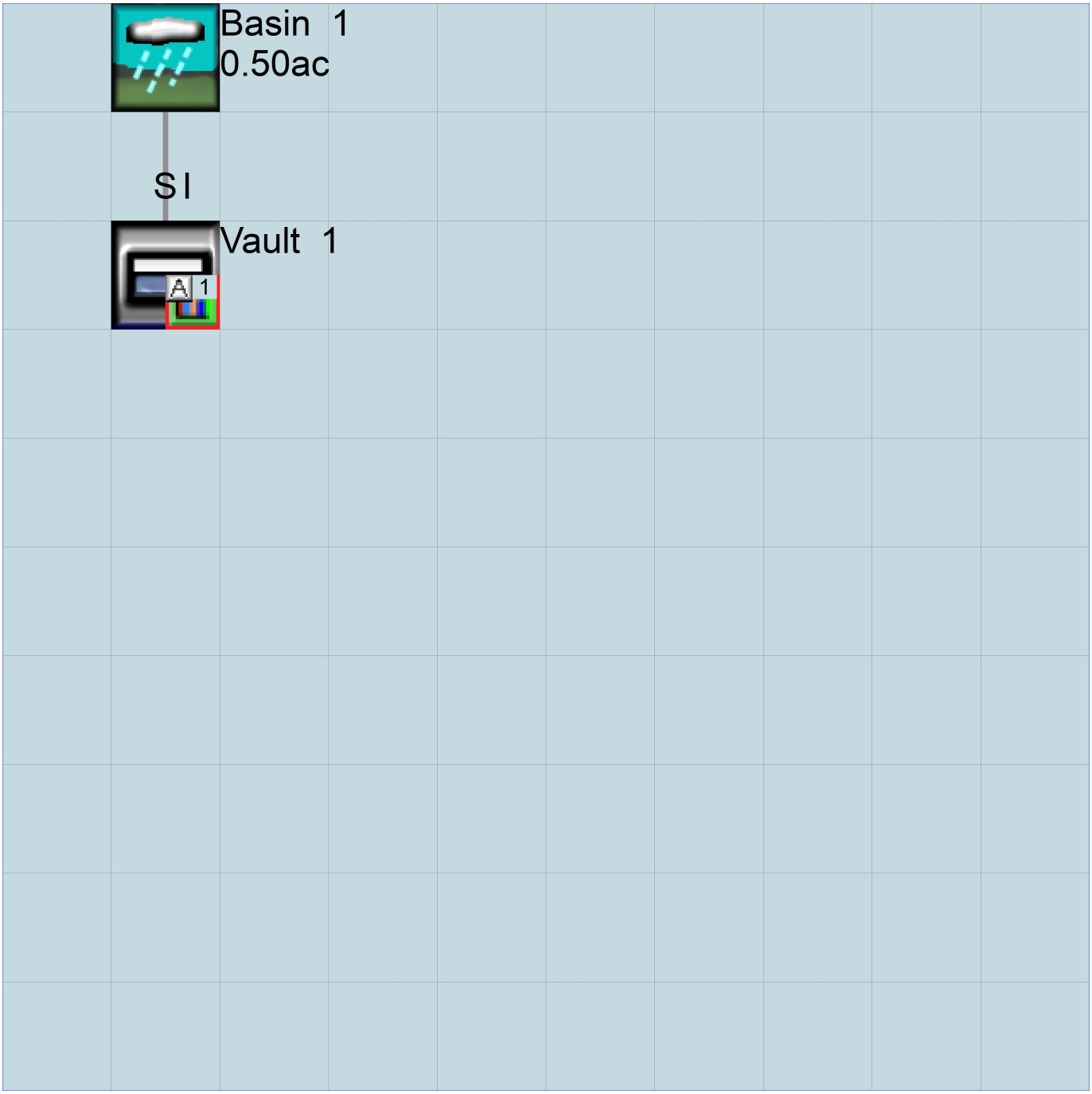
## IMPLND Changes

No IMPLND changes have been made.

# *Appendix*
## *Predeveloped Schematic*



## *Mitigated Schematic*



## *Predeveloped UCI File*

## *Mitigated UCI File*

## *Predeveloped HSPF Message File*

## *Mitigated HSPF Message File*

# Disclaimer

## Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages. Software Copyright © by : Clear Creek Solutions, Inc. 2005-2020; All Rights Reserved.

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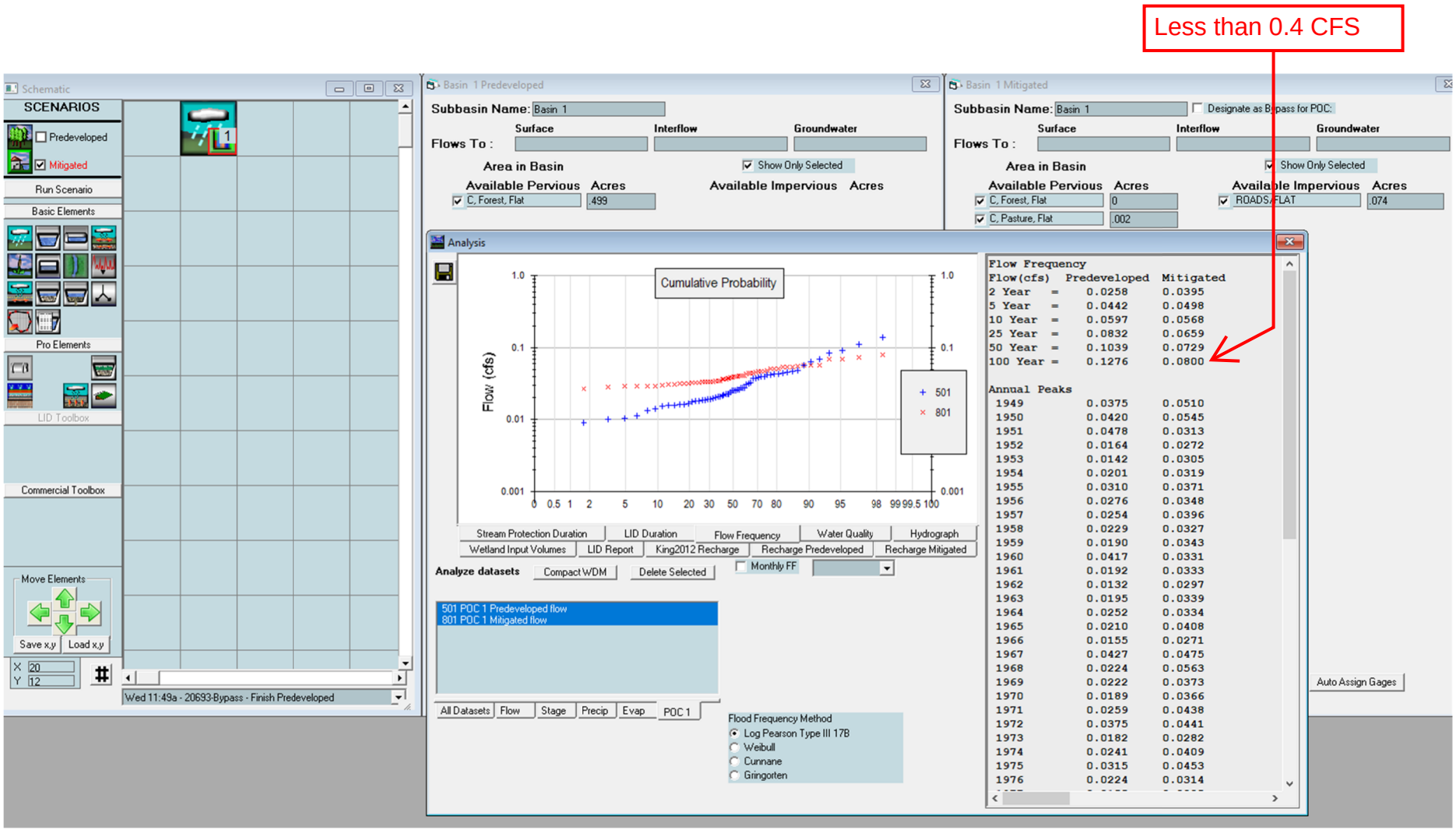
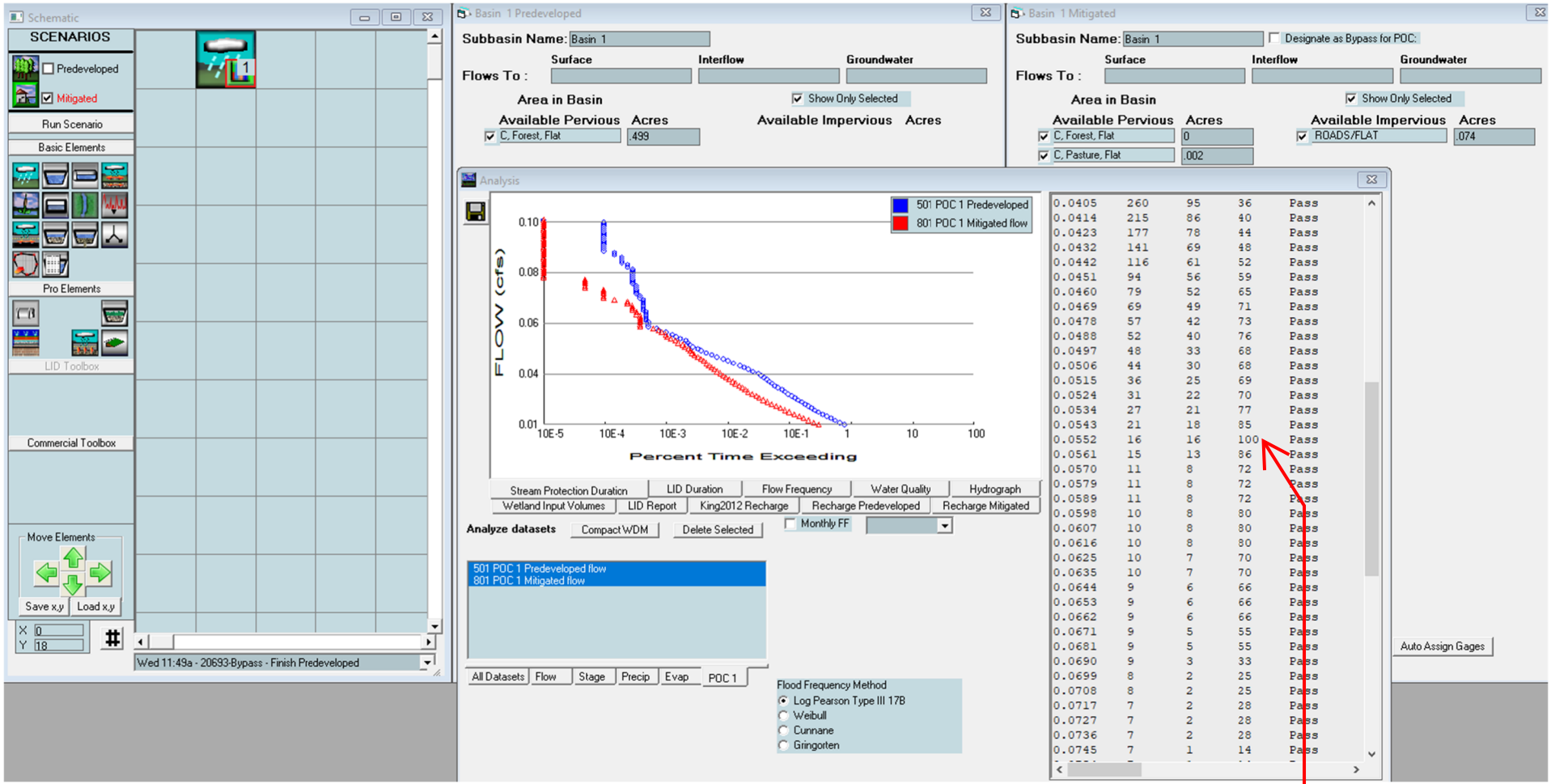
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

# Figure 5.8
# Bypass Runoff Calculations


Less than 0.4 CFS
Schematic
SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
LID Toolbox
Commercial Toolbox
Move Elements
Save x,y
Load x,y
Wed 11:49a - 20693-Bypass - Finish Predeveloped
Basin 1 Predeveloped
Subbasin Name: Basin 1
Surface
Interflow
Groundwater
Flows To :
Area in Basin
Show Only Selected
Available Pervious Acres
C, Forest, Flat .499
Available Impervious Acres
Basin 1 Mitigated
Subbasin Name: Basin 1
Designate as Bypass for POC:
Flows To :
Area in Basin
Show Only Selected
Available Pervious Acres
C, Forest, Flat 0
C, Pasture, Flat .002
Available Impervious Acres
ROADS/FLAT .074
Analysis
Cumulative Probability
Flow (cfs)
501
801
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
King2012 Recharge
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
Delete Selected
Monthly FF
501 POC 1 Predeveloped flow
801 POC 1 Mitigated flow
All Datasets
Flow
Stage
Precip
Evap
POC 1
Flood Frequency Method
Log Pearson Type III 17B
Weibull
Cunnane
Gringorten
Flow Frequency
Flow(cfs) Predeveloped Mitigated
2 Year = 0.0258 0.0395
5 Year = 0.0442 0.0498
10 Year = 0.0597 0.0568
25 Year = 0.0832 0.0659
50 Year = 0.1039 0.0729
100 Year = 0.1276 0.0800
Annual Peaks
1949 0.0375 0.0510
1950 0.0420 0.0545
1951 0.0478 0.0313
1952 0.0164 0.0272
1953 0.0142 0.0305
1954 0.0201 0.0319
1955 0.0310 0.0371
1956 0.0276 0.0348
1957 0.0254 0.0396
1958 0.0229 0.0327
1959 0.0190 0.0343
1960 0.0417 0.0331
1961 0.0192 0.0333
1962 0.0132 0.0297
1963 0.0195 0.0339
1964 0.0252 0.0334
1965 0.0210 0.0408
1966 0.0155 0.0271
1967 0.0427 0.0475
1968 0.0224 0.0563
1969 0.0222 0.0373
1970 0.0189 0.0366
1971 0.0259 0.0438
1972 0.0375 0.0441
1973 0.0182 0.0282
1974 0.0241 0.0409
1975 0.0315 0.0453
1976 0.0224 0.0314
Auto Assign Gages


Schematic
SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
LID Toolbox
Commercial Toolbox
Move Elements
Save x,y
Load x,y
Wed 11:49a - 20693-Bypass - Finish Predeveloped
Basin 1 Predeveloped
Subbasin Name: Basin 1
Flows To :
Surface
Interflow
Groundwater
Area in Basin
Show Only Selected
Available Pervious
Acres
C, Forest, Flat
499
Available Impervious
Acres
Basin 1 Mitigated
Subbasin Name: Basin 1
Designate as Bypass for POC:
Flows To :
Surface
Interflow
Groundwater
Area in Basin
Show Only Selected
Available Pervious
Acres
C, Forest, Flat
0
C, Pasture, Flat
002
Available Impervious
Acres
ROADS/FLAT
074
Analysis
501 POC 1 Predeveloped
801 POC 1 Mitigated flow
FLOW (cfs)
Percent Time Exceeding
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
King2012 Recharge
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
Delete Selected
Monthly FF
501 POC 1 Predeveloped flow
801 POC 1 Mitigated flow
All Datasets
Flow
Stage
Precip
Evap
POC 1
Flood Frequency Method
Log Pearson Type III 17B
Weibull
Cunnane
Gringorten
Auto Assign Gages
Bypass Areas alone matches entire pre-developed site. Cannot model as "bypass" in detention calcs.

## 5.6 Water Quality System

The project is defined as a commercial project, on a high use site, and proposes greater than 5,000 square feet of new and replaced pollution generating hard surface area. Enhanced treatment, and phosphorus removal is required to be provided in this project's stormwater design. Enhanced treatment, and phosphorus removal will be provided by a Bio clean Environmental MWS-Linear Modular Wetland system that will treat stormwater runoff off-line and upstream of the proposed detention facility. Additionally oil control will be provided by an off-line oil/water separator located upstream of the proposed treatment facility.

**ROW PGHS**

All runoff from new and replaced pollution generating hard surfaces within the right-of-way cannot be feasibly isolated and treated from runoff of the adjacent road surfaces. This project will provide treatment for an area within the right-of-way greater than or equal to the proposed new and replaced pollution generating hard surfaces that will bypass the on-site facility. Treatment within the right-of-way will be provided by a Contech Stormfilter Catch basin.

Figure 5.9
Contech WQ
Basin Map

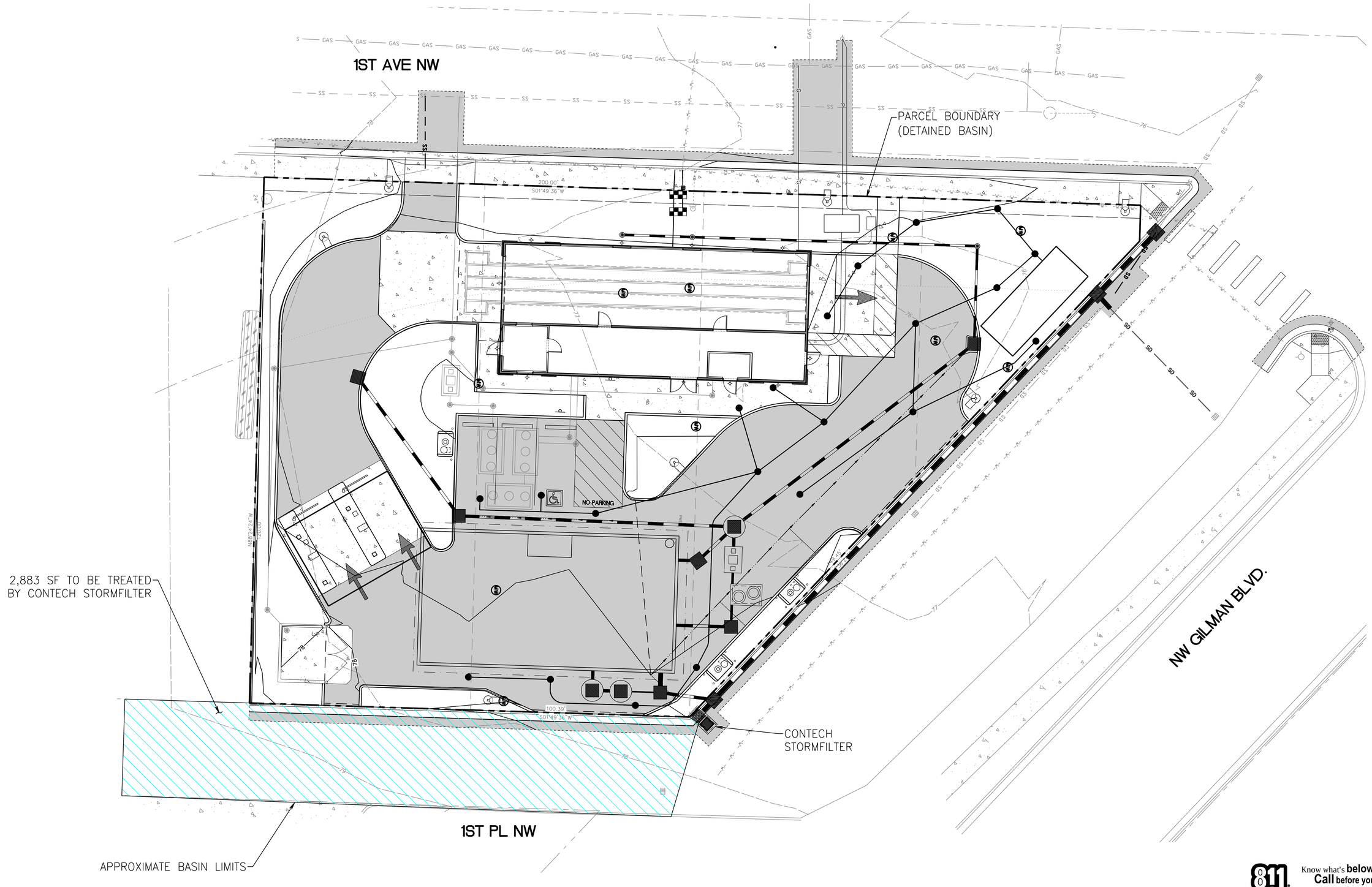
# CONTECH WQ BASIN MAP

FOR

# BROWN BEAR CAR WASH

SE $\frac{1}{4}$ OF NE $\frac{1}{4}$ OF SEC. 28, TWN. 24 N, RGE. 6 E, W.M.
CITY OF ISSAQUAH, KING COUNTY, WASHINGTON

1"=10'
0 5 10 20




Know what's **below.**
**Call** before you dig.
Dial 811

| No. | Date | By | Ckd. | Appr. | Revision |
|---|---|---|---|---|---|
| 2 | 4/3/2020 | ADW | AEM | CRJ | PER CITY REVIEW COMMENTS RECIEVED 02/19/2020 |
| 1 | 11/15/19 | ADW | AEM | CRJ | LAND USE SUBMITTAL |

Title: **CONTECH WQ BASIN MAP**
BROWN BEAR CAR WASH
55 NW GILMAN BLVD.
ISSAQUAH, WA

For: CAR WASH ENTERPRISES, INC.
3977 LEARY WAY NW
SEATTLE, WASHINGTON 98107

4/3/2020

Scale: Horizontal 1" = 10' Vertical NA

Designed ADW Drawn ADW Checked AEM Approved CRJ Date 11/15/19


**Barghausen**
**Consulting Engineers, Inc.**
18215 72nd Avenue South
Kent, WA 98032
425.251.6222 **barghausen.com**


Job Number 20693

Sheet 1 of 1

P:\20000s\20693\exhibit\20693-Contech WQ Basin Map.dwg 4/1/2020 4:58 PM AWHITE

## 5.7 Conveyance System Analysis and Design

All proposed conveyance systems are anticipated to provide adequate capacity for on-site runoff flows. Conveyance system calculations may be provided upon a subsequent submittal at the request of the City of Issaquah.

# Tab 6.0

## 6.0 CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

**THE FOLLOWING IS A LIST OF THE TWELVE SWPPP ELEMENTS AND HOW THEY HAVE BEEN ADDRESSED FOR THIS PROJECT:**

**Element No. 1 - Preserve Vegetation / Mark Clearing Limits:** Clearing Limits will be delineated on the engineering plans and will be flagged in the field.

**Element No. 2 - Establish Construction Access:** A stabilized gravel construction entrance will be shown on the engineering plans. Construction access will be taken from the Alley located along the project's east boundary.

**Element No. 3 - Control Flow Rates:** A temporary sediment ponds will be shown on the engineering plans. Once the permanent detention facilities are constructed the temporary sediment ponds can be removed. The permanent facilities can be used throughout the remainder of construction.

**Element No. 4 - Install Sediment Controls:** Silt fence will be shown on the engineering plans for perimeter protection. In addition, temporary ditches to divert runoff to the sediment pond will be shown on the engineering plans.

**Element No. 5 - Stabilize Soils:** Cover measures will be addressed in the TESC notes on the engineering plans.

**Element No. 6 - Protect Slopes:** There are no significant slopes onsite, existing or proposed that require additional measures beyond the soil stabilization measures to be shown on the engineering plans.

**Element No. 7 - Protect Permanent Drain Inlets:** A detail for catch basin inserts will be shown on the final engineering plans along with a note specifying that they be installed once the permanent storm system is completed. A note will also be included that the contractor shall keep public roadways clear of dirt and debris.

**Element No. 8 - Stabilize Channels and Outlets:** Notes regarding outfall protection will be shown on the engineering plans. Temporary ditches shall be armored with rip rap for slopes greater than 5 percent.

**Element No. 9 - Control Pollutants:** A note will be added to the engineering plans that the contractor shall dispose of all pollutants and waste materials in a safe and timely manner.

**Element No. 10 - Control Dewatering:** Notes will be added to the engineering plans stating that water in underground utility trenches or low spots are to be routed to the temporary sediment pond via temporary ditches or perforated rock drains.

**Element No. 11 - Maintain Best Management Practices** Once the engineering plans are completed the contractor shall maintain all erosion control measures in accordance with City of Issaquah and manufactures recommendations. In addition, the contractor shall maintain a stockpile of erosion control materials onsite.

**Element No. 12 - Manage the Project:** Once the engineering plans are completed, the clearing, grading, and seasonal work shall be performed in accordance with the City of Issaquah. The contractor shall inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. In addition to the engineering plans the contractor will be required to follow and maintain the Construction SWPPP which has been prepared according to Department of

Ecology NPDES Requirements. The completed SWPPP and TESC Plans will be provided during Final Engineering Review.

**Element No. 13 – Protect Low Impact Development BMPs:** Areas that apply BMP T5.13: Post Construction Soil Quality and Depth must be protected from vehicular compaction and excessive foot traffic.

# Tab 7.0

## 7.0 SPECIAL REPORTS AND STUDIES

1) *Geotechnical Engineering Report*
*Brown Bear Car Wash*
*55 Northwest Gilman Boulevard*
*Issaquah, Washington*

Prepared by: Aspect Consulting
710 2nd Avenue, Suite 500
Seattle, WA 98104
Tel: (206) 780-7727

# GEOTECHNICAL ENGINEERING REPORT
# BROWN BEAR CAR WASH
## 55 Northwest Gilman Boulevard
## Issaquah, Washington

Prepared for: Car Wash Enterprises, Inc.

Project No. 080109 • November 7, 2019 DRAFT

Aspect CONSULTING

earth + water

# GEOTECHNICAL ENGINEERING REPORT
# BROWN BEAR CAR WASH

55 Northwest Gilman Boulevard
Issaquah, Washington

Prepared for: Car Wash Enterprises, Inc.

Project No. 080109 • November 7, 2019 • DRAFT

Aspect Consulting, LLC


PRELIMINARY

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Geotechnical Engineer
rkilkenny@aspectconsulting.com

**Henry H. Haselton, PE**
Principal Geotechnical Engineer
hhaselton@aspectconsulting.com

V:\080109 Car Wash Enterprises\Deliverables\001-12 Gilman Blvd\Geotechnical Study\DRAFT\Issaquah Brown Bear_DRAFT_20191107.doc

# Contents

## List of Tables



## List of Figures



## List of Appendices

# 1 Introduction

This report presents the results of a geotechnical engineering study completed by Aspect Consulting, LLC (Aspect) on behalf of Car Wash Enterprises, Inc. (CWE) to fulfill the City of Issaquah requirement for a Soils Report for the Brown Bear Car Wash redevelopment (Project) located at 55 NW Gilman Blvd in Issaquah, Washington (Site; Figure 1). This report is intended to be used as an attachment for the City of Issaquah Land Use permit; it is for planning purposes only and not to be used as a stand-alone document.

This report summarizes explorations and geotechnical data collected to date, and presents our geotechnical engineering conclusions and recommendations based on the geotechnical data and current building concepts. The information and recommendations presented in this report are intended to assist the design team in the selection of foundation alternatives, construction methods, and to inform construction cost estimates for the Project.

## 1.1 Project Description

The Site has a history of use as a gasoline service station and car care facility. Environmental impacts are present in the Site soil and groundwater as a result of the historical operations. CWE has been conducting an environmental remediation in conjunction with plans to redevelop the Site as a car wash facility. Previous cleanup efforts included excavation of impacts to depths of 13 feet below ground surface and backfilling with clean fill, while future cleanup efforts will likely include the installation of an air sparging/soil vapor extraction (AS/SVE) system to treat deeper impacts. The current use of the site is a level gravel pad.

The proposed redevelopment of the Site includes the design and construction of a new Brown Bear Car Wash. The proposed 3,500 square foot car wash building is expected to consist of a single-story structure supported by shallow spread or strip footings bearing directly on the fill placed during the previous cleanup efforts. Foundation loads are expected to be typical of a building of this type and size. Small amounts of subsurface grading are expected to be required to install below-grade utilities and to manage Site drainage. Aspect's current understanding of the proposed development can be found on Figure 2.

# 2 Site Conditions

## 2.1 Surface

Current Site surface conditions consist a generally flat gravel pad, which has been backfilled after a recent remedial excavation. The western edge of the Site is bound by 1st Avenue NW. The eastern and northern edge of the Site is bound by an alley. The southern edge of the Site is bound by the Valvoline Instant Oil Change property.

## 2.2 Subsurface Conditions

The subsurface conditions at the Site were inferred from our review of geologic maps and explorations advanced at the Site by Aspect. The explorations by Aspect consisted of two hollow-stem auger borings. The location of these borings is shown on Figure 2. A detailed description of the exploration methods used, and our exploration logs are provided in Appendix A.

### *2.2.1 General Geology*

The geologic map of Issaquah maps the Site as being underlain by Holocene Fan deposits (Booth, 2006). These deposits generally consist of boulders, cobbles, sand, and diamict deposited in a lobate form where streams emerge from confining valleys, and the reduced gradients cause some of their sediment loads to be deposited. These units generally grade with Holocene alluvium deposits.

### *2.2.2 Stratigraphy*

Based on the completed subsurface explorations, we grouped the Site soils into two units: fill, and alluvium. Based on our understanding of the Site and our explorations, fill was placed to backfill the Site from a recent environmental remediation excavation a raise grades back to ground surface, as needed, throughout the Site.

The composition and distribution of these units are summarized below. For more detailed information regarding the composition and distribution of these units, please refer to the exploration logs provided in Appendix A.

#### Fill

Up to about 13 feet of fill was observed in our explorations ASB-01 and ASB-02. The fill typically consisted of medium dense to very dense, moist, brown and gray, silty gravel with sand (GM).

#### Alluvium

Alluvium was observed in both borings, AB-01 and AB-02 from depths of about 13 feet to the termination depths of the borings. The outwash generally consisted of medium dense to very dense, wet, brown and gray, gravel and sand with varying amount of silt

(GM and SM). A two-foot-thick layer of medium stiff silt with sand was also encountered from 13 to 15 feet below ground surface in ASB-01,

### 2.2.3 Groundwater

Groundwater levels were inferred from sample moisture at the time of drilling to be approximately 12 to 15 feet bgs. Groundwater levels at the Site are expected to fluctuate seasonally with changes in precipitation, Site usage, and other factors.

### 2.2.4 Critical/Geologically Hazardous Areas

Typical critical and geologically hazardous areas present in the Puget Sound area include landslide, erosion, liquefaction, wetland, and fault ground rupture critical/hazard areas. Based on the Site location, topography, surface conditions, and subsurface conditions, we conclude that of these critical/geologically hazardous areas, only liquefaction is relevant to the Site. The Washington Geologic Information Portal (DNR, 2019) indicates that of these hazard areas, the Site has a moderate to high susceptibility to liquification. The liquefaction susceptibility is further described in Section 3.2.

The Site is located in a seismically active region and subject to strong ground shaking during earthquakes. Accordingly, new structures should be designed to account for ground shaking in accordance with the current applicable building codes.

# 3 Seismic Hazard Evaluation

The Site is located within a region of active tectonic forces associated with the interaction of the offshore Juan de Fuca Plate, the Pacific Plate, and the onshore North American Plate. Seismic hazards include strong ground shaking from earthquakes associated with the Seattle Fault Zone (SFZ), the Cascadia Subduction Zone (CSZ), and deep intraslab earthquakes.

The SFZ is a zone of east-west thrust faults. The U.S. Geological Survey (USGS) estimates that the SFZ can produce earthquakes of magnitude 7.0 or greater. The last large earthquake on this fault system occurred about 1,100 years ago and resulted in up to 27 feet of uplift in parts of West Seattle.

The CSZ lies along the boundary of the converging oceanic plates (Juan de Fuca and Pacific Plates) and continental plate (North American Plate). CSZ earthquakes occur due to rupture between the subducting oceanic plate and the overlying continental plates. The CSZ can produce earthquakes up to magnitude 9.3, and the recurrence interval is thought to be on the order of about 500 years. The most recent subduction zone earthquake was estimated to occur about 300 years ago.

Deep intraslab earthquakes, which occur from tensional rupture of the sinking oceanic plate, are also associated with the CSZ. An example of this type of seismicity is the 2001 Nisqually earthquake. Deep intraslab earthquakes typically are magnitude 7.5 or less and occur approximately every 10 to 30 years.

## 3.1 Seismic Design Parameters

Seismic design for the Project will be for a "Maximum Considered Earthquake" (MCE) with an earthquake ground motion that has 2 percent probability of exceedance in 50 years, or a return period of approximately 2,500 years. The effects of Site-specific subsurface conditions on the earthquake ground motion at the ground surface are determined based on the "Site Class." The Site Class can be correlated to the average standard penetration resistance (N-value) or average shear wave velocity in the upper 100 feet of the soil profile. Based on the subsurface explorations completed at the Site, the soil profile below each building would classify as Site Class D (Stiff Soil Profile).

We understand the buildings will be permitted after the adoption of the 2018 International Building Code (IBC) and the American Society of Civil Engineers (ASCE) 7-16, *Minimum Design Loads for Buildings and Other Structures* (ASCE, 2017). The seismic design parameters, in accordance with the 2018 IBC and ASCE 7-16, and adjusted for Site Class D, are provided in Table 1.

**Table 1. Seismic Design Parameters**

| Ground Motion Parameter | Recommended Value |
|---|---|
| Site Class | D– "Stiff Soil" |
| Short Period Spectral Acceleration, $S_s$ (g) | 1.311 |
| 1-Second Period Spectral Acceleration, $S_1$ (g) | 0.453 |
| Site Coefficient ($F_a$) | 1.0 |
| Site Coefficient ($F_v$) | 1.847 |
| Design Short Period Spectral Acceleration, $S_{DS}$ (g) | 0.874 |
| Design 1-Second Period Spectral Acceleration, $S_{D1}$ (g) | 0.558 |
| Site-Adjusted Peak Ground Acceleration (g) | 0.616 |

**Note:** Parameters based on the latitude and longitude of the Site: 47.537973°N, 122.037268°W

## 3.2 Liquefaction Susceptibility

Liquefaction occurs when loose, saturated, and relatively cohesionless soil deposits temporarily lose strength and stiffness as a result of earthquake shaking. Potential effects of soil liquefaction include temporary loss of shallow-foundation bearing capacity, loss of deep-foundation axial and lateral capacity, vertical ground settlement, creekbank slope failure, and lateral ground movement towards creek banks or shoreline areas—any of which could result in structural damage. Primary factors controlling the triggering of liquefaction include intensity and duration of strong ground motion, characteristics of subsurface soils, *in situ* stress conditions, and the depth to groundwater.

Our explorations reveal that below the groundwater table, soils have sufficient relative density or plasticity/cohesiveness to render them nonsusceptible to liquefaction. Therefore, we conclude that liquefaction is not a design consideration at the Site.

## 3.3 Surficial Ground Rupture

Due to the suspected long recurrence interval, and the distance of the Site from the nearest known strand of the SFZ, and the great distance of the site from the CSZ, the potential for surficial ground rupture at the Site is considered low during the expected life of the structure.

# 4 Geotechnical Engineering Conclusions and Recommendations

## 4.1 Shallow Foundations on Fill

### *4.1.1 Allowable Bearing Pressure*

In our opinion, shallow spread footings are feasible for the new building. Shallow foundations bearing directly on fill soils may be designed for an allowable bearing pressure of 3 kips per square foot (ksf). This allowable bearing pressure assumes the foundations are embedded a minimum of 24 inches below the ground surface and a minimum square footing dimension of 3 feet or a strip footing width of 2.5 feet. The allowable bearing pressure may be increased by one-third for short-duration loading, such as wind and seismic loading.

### *4.1.2 Settlement*

We estimate footings bearing on the fill and designed in accordance with our recommendations will experience average total settlements of 1 inch or less. Differential settlements between adjacent column footings can be assumed to be about one-half of the total settlement. Differential settlement along continuous strip footings can be assumed to be approximately 0.5 inches per 25 feet of footing length. Total and differential settlement will occur rapidly as building loads are applied.

### *4.1.3 Lateral Resistance*

To resist lateral loading, we recommend using an allowable passive equivalent fluid density of 300 pounds per cubic foot and an allowable base friction coefficient of 0.33 for foundations embedded in the fill. These allowable values include a factor of safety of 1.5.

## 4.2 Slabs-on-Grade

Concrete slabs-on-grade for the car wash building should be designed in accordance with the American Concrete Institute (ACI) Committee 360 Guide to Design of Slabs-on-Ground (ACI, 2010). We recommend the slab be underlain with 6 inches of free-draining, crushed rock or well-graded sand and gravel to provide a uniform support. The crushed rock material should have a maximum particle size of 3/4 inch, with no more than 80 percent passing the No. 4 sieve and less than 5 percent fines (material passing the U.S. Standard No. 200 sieve).

For slabs that are designed as beam-on-elastic foundation, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be assumed for design.

## 4.3 Construction Dewatering

We do not expect the excavations for the shallow foundations to encounter groundwater. If small amounts of groundwater are encountered during construction, we expect it can be managed using sumps and pumps at the discretion of the contractor.

## 4.4 Pavement Design and Construction Considerations

We anticipate new access driveway areas and passenger vehicle parking areas will be paved with flexible hot mix asphalt (HMA). In asphalt driveway or parking areas where heavy trucks are anticipated to operate, we recommended the pavement section consist of 3 inches of HMA over 6 inches of crushed surfacing base and top course.

We recommend Crushed Surfacing Base Course (CSBC) for the pavement base course, and Crushed Surfacing Top Course (CSTC) may be used over the CSBC for the upper 2 to 3 inches of the base course section. CSBC and CSTC, as specified in Section 9-03.9(3) of the *Standard Specifications* (WSDOT, 2019), should be used as base course for pavements.

## 4.5 Stormwater Infiltration

The City of Issaquah utilizes the Washington State Department of Ecology Water Quality Program *Stormwater Management Manual for Western Washington* (SWMMWW; Ecology, 2014). The SWMMWW states that utilizing infiltrating BMPs is infeasible for properties within 100 feet of an area known to have deep soil contamination. Due to the presence of environmentally impacted soil and groundwater beneath the Site, we consider shallow stormwater infiltration to be inadvisable. We recommend stormwater management be accomplished utilizing storm drainpipes that discharge into an appropriate system which will not infiltrate into the groundwater.

# 5 Earthwork Considerations and Recommendations

Excavation for the Project will occur mostly in dense sand and gravel fill. We anticipate excavation can take place with standard excavation equipment, such as tracked excavators.

## 5.1 Temporary Excavation Slopes

Temporary excavation slopes will be required for installation of spread footings and utilities. Temporary excavation and slopes should not exceed the limits specified in the local, state, and federal regulations. The stability of temporary excavations and slopes shall be the responsibility of the contractor. The fill deposits are classified as Type C soil in accordance with the Washington Administrative Code (WAC) 296-155 Part N (WAC, 2016). Temporary excavation slopes in Type C soils are anticipated to stand as steep as 1.5H:1V (Horizontal:Vertical). If unexpected seepage is encountered, the temporary excavation slopes may be required to be flattened to remain stable.

We also recommend the following:

- Surface water should be diverted away from slopes.
- Protect slopes using plastic sheet, flash coating, or tarps to control erosion and stability, as necessary.
- Limit the duration that excavations or slopes are open to the shortest time possible.
- Traffic, equipment, and material stockpiles should not be allowed near the top of excavations or slopes.
- The conditions of the excavations and slopes should be periodically observed by a competent person, who is a representative of the contractor, to evaluate safety and stability.

## 5.2 Subgrade Preparation

### *5.2.1 Shallow Foundations*

Foundation subgrades should be firm and unyielding and clear of all construction debris, loose or disturbed soil, and standing water prior to foundation construction. Soft or disturbed foundation subgrade areas, such as organic material, should be removed and replaced with structural fill. If organic material is encountered, it should be overexcavated until the competent fill is exposed and replaced with structural fill to reach the desired grade. Foundation preparation should be observed by Aspect prior to placing steel and pouring concrete to verify they have been prepared in conformance with our recommendations.

### 5.2.2 Slabs-on-Grade and Pavements

Slab-on-grade subgrade preparation should be observed and evaluated by a representative of Aspect prior to placement of the concrete or pavement section. All subgrade should be firm and unyielding under the proof-rolling load of heavy rubber-tired equipment where accessible and should be clear of any loose or disturbed soil or standing water. Disturbed or soft subgrade areas identified during evaluation should be removed and replaced with structural fill.

### 5.2.3 Pavement

The near-surface fill will provide suitable support for new pavement sections provided that any zones of concentrated organics and deleterious debris are removed from the pavement subgrade. All pavement subgrades should be carefully prepared. Prior to placing base course and pavement, all standard pavement subgrades should be proof-rolled with a fully loaded 10-cubic-yard dump truck or equivalent. An Aspect geotechnical engineer or engineering geologist should observe and evaluate the proof rolling operation. Any soft areas detected by the proof-rolling or other methods should be compacted in place or overexcavated to firm ground and backfilled with compacted structural fill to the design subgrade elevation. To provide for quality construction practices and materials, we recommend all pavement work and mix-design considerations conform to WSDOT standards.

The recommended pavement section is not intended to support extensive construction traffic, such as dump trucks and concrete Redi-mix trucks. Pavements subject to heavy construction traffic may be damaged and require repair.

Drainage is an essential aspect of pavement performance. We recommend providing all paved areas with positive drainage to remove surface water and water within the base course. This will be particularly important in cut sections or at low points within the paved areas, such as at catch basins.

## 5.3 Structural Fill

Soils placed beneath or around foundations, walls, utilities, slabs-on-grade, or below pavements should be considered structural fill. For these fill areas, we provide the following recommendations:

- Site-derived fill soils are suitable for reuse as structural fill but may be difficult to compact during wet weather. Additional fill can be imported per the recommendations below. Organic material or any soils with deleterious matter cannot be reused as structural fill.
- Structural fill to be used below foundations (for removal and replacement scenarios) can consist of appropriate on-Site material or crushed rock meeting the requirements for WSDOT Standard Specification Crushed Surfacing 9-03.9(3) (WSDOT, 2018).
- Structural fill should only be placed on a relatively firm and unyielding subgrade. The exposed subgrade soils should be compacted (in place) to a dense and unyielding condition prior to placement of structural fill.

- Structural fill should be compacted to a relatively firm and unyielding condition to a minimum density of 95 percent of the maximum dry density as determined by ASTM International (ASTM) D1557 (ASTM, 2018).
- Structural fill should be placed in lifts with a loose thickness no greater than 12 inches when using relatively large compaction equipment, such as a vibrating plate attached to an excavator (hoe pack) or drum roller. If small, hand-operated compaction equipment is used to compact structural fill, lifts should not exceed 6 inches in loose thickness.
- Moisture content of the structural fill should be controlled to within 2 to 3 percent of the optimum moisture. Optimum moisture is the moisture content corresponding to the maximum modified proctor dry density.
- Fill placed in softscape, general grading, landscape, or common areas that are not beneath or around structures, utilities, slabs-on-grade, or below paved areas that can accommodate some settlement should be compacted to a relatively firm and unyielding condition.

## 5.4 Utility Bedding and Backfill

General recommendations for bedding of utilities and backfill of utility trenches include:

- Materials to be used for utility bedding should consist of appropriate onsite material, meet the requirements WSDOT Standard Specification 9-03.9(3), or be as specified in the Standard Specification section applicable to the type of pipe being installed.
- Prior to installation of the pipe, the bedding material should be shaped to fit the lower portion of the pipe exterior with reasonable closeness to provide continuous support along the pipe.
- Bedding placed around the pipe should be placed in layers and tamped around the pipe to obtain complete contact. Pipe bedding material should be used as trench backfill to at least 6 inches above the crown of the pipe, for the full width of the trench. In areas where a trench box is used, the bedding material should be placed before the trench box is advanced.
- Trench backfill should meet the requirements for Structural Fill as described in Section 5.3 of this report. During placement of the initial lifts, the trench backfill material should not be bulldozed into the trench or dropped directly on the pipe. Furthermore, heavy vibratory equipment should not be permitted to operate over the pipe until at least 2 feet of backfill has been placed.

## 5.5 Temporary Erosion and Sedimentation Control

Temporary erosion-control measures should be implemented to prevent the migration of soil, dust, and turbid water off-Site or into stormwater systems. Such measures should include silt fences and straw wattles at the Site boundary, silt socks in nearby catch basins, wetting exposed soil during dry periods, and quarry spalls and wheel wash stations at truck and equipment exits.

## 5.6 Wet Weather Construction

Earthwork is typically most economical when performed under dry weather conditions. If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions, we provide the following recommendations:

- Earthwork should be performed in small areas to minimize exposure to wet weather. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- Excavations for foundations, floor slabs, and pavements should be covered or protected (with concrete or WSDOT Standard Specification 9-03.9(3)) following approval of the subgrade by Aspect and should not be left open and exposed.
- Material used as structural fill should consist of clean, granular soil containing less than 7 percent fines.
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller (or equivalent) and under no circumstances should be left uncompacted and exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials.
- Excavation and placement of fill should be observed by Aspect to verify that all unsuitable materials are removed, and suitable compaction is achieved.
- Local best management practices (BMPs) for erosion protection should be strictly followed.

# 6 Additional Design and Construction Monitoring

At the time of this report, concept Site plans, Site grading, structural plans, and construction methods have not been developed or finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes to the assumptions made herein, we should be contacted to determine if our recommendations should be revised. We recommend that we have an opportunity to review and provide input on Site development plans as they are advanced to ensure that the recommendations of this report are appropriately incorporated into the Site design.

We are available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundation depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent.

# 7 References

American Concrete Institute (ACI) Committee 360, 2010, Guide to Design of Slabs-on-Ground.

American Society of Civil Engineers (ASCE), 2017, 7-16, Minimum Design Loads for Buildings and Other Structures.

ASTM International (ASTM), 2018, 2018 Annual Book of ASTM Standards, West Conshohocken, Pennsylvania.

Goldsmith Land Development Services (Goldsmith), 2017, ATLA/NSPS Land Title Survey for Lake Union Partners, Sheet 1 of 2 and 2 of 2, August 24, 2017.

Washington State Department of Ecology Water Quality Program (Ecology), 2014, 2014 Stormwater Management Manual for Western Washington.

Washington State Department of Natural Resources Division of Geology and Earth Resources (DNR), 2019, Washington Interactive Geologic Map, 2019, online at: https://fortress.wa.gov/ndr/protectiongis/geology/?Theme=wigm.

Washington State Department of Transportation (WSDOT), 2019, Standard Specifications for Road, Bridge and Municipal Construction, Document M 41-10.

Washington State Legislature, 2016, Washington Administrative Code (WAC), May 20, 2016.

# 8 Limitations

Work for this project was performed for Car Wash Enterprises, Inc. (Client), and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Aspect Consulting, LLC (Aspect).

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Client. Application of this report for any purpose other than the project should be done only after consultation with Aspect.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Aspect should be notified immediately to review the applicability of our recommendations.

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. At the time of this report, design plans and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes from the preliminary project information, Aspect should be contacted to determine if our recommendations contained in this report should be revised and/or expanded upon.

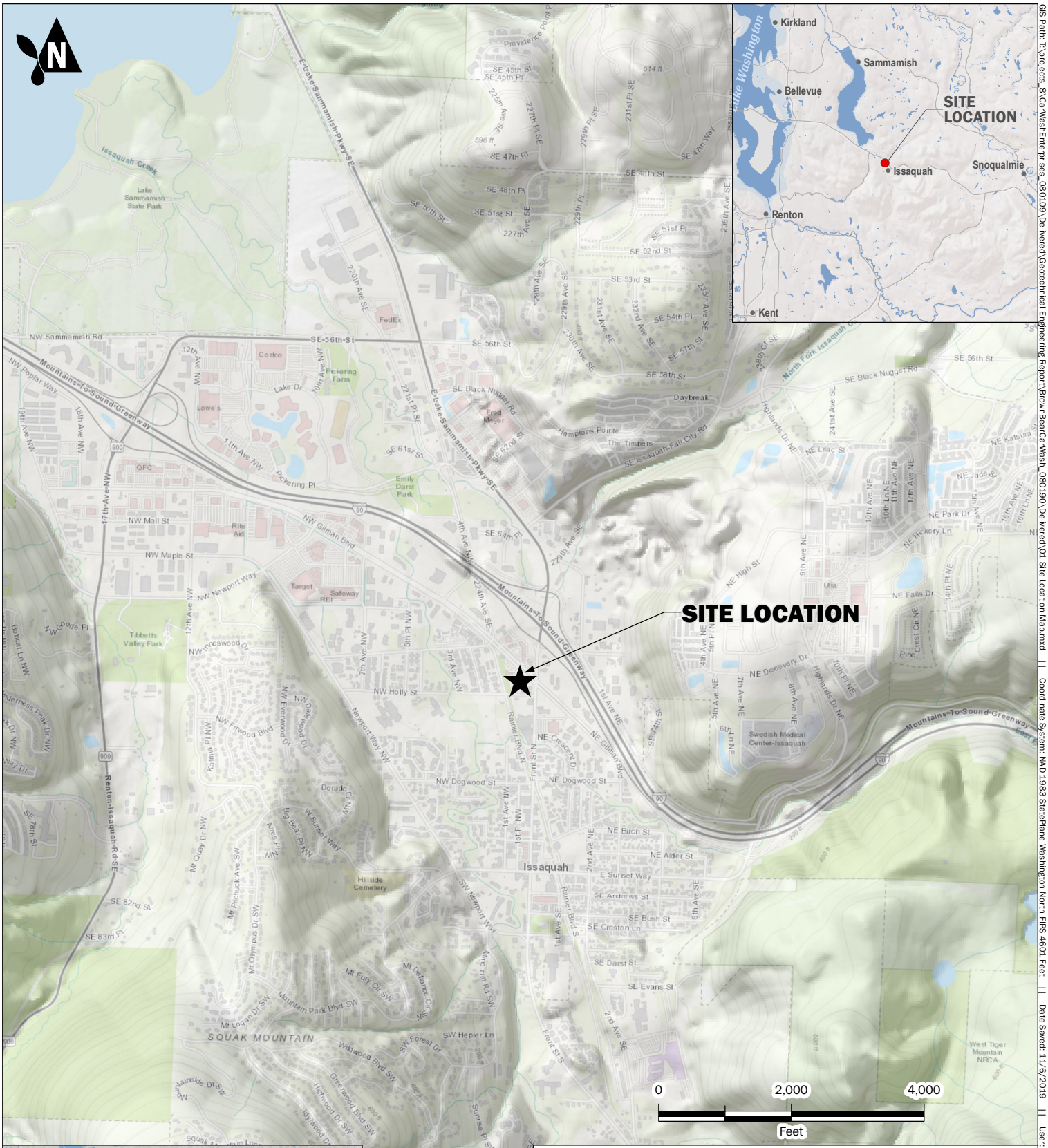
The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor’s site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

All reports prepared by Aspect for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect. Aspect’s original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

**Please refer to Appendix B titled “Report Limitations and Guidelines for Use” for additional information governing the use of this report.**

We appreciate the opportunity to perform these services. If you have any questions, please call Rory Kilkenny PE, Geotechnical Engineer, at 541.256.0037.

# FIGURES



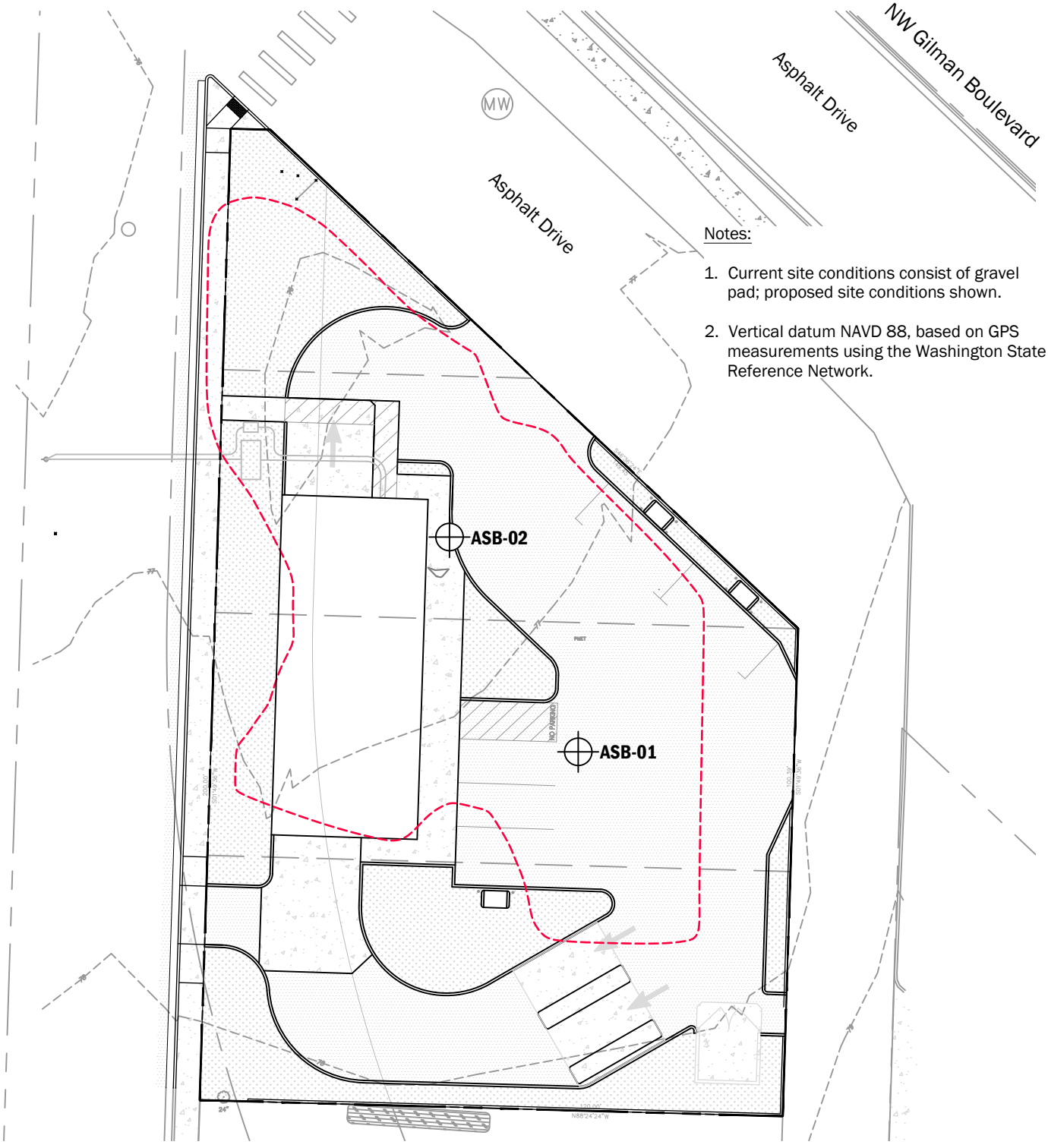

# Site Location Map

Geotechnical Engineering Report
Car Wash Enterprises
55 NW Gilman Boulevard
Issaquah, Washington

| | | | |
|---|---|---|---|
| Aspect CONSULTING | NOV-2019 | BY: RPK / WEG | FIGURE NO. 1 |
| | PROJECT NO. 080190 | REVISED BY: --- | |

GIS Path: T:\projects_8\CarWashEnterprises_080109\Delivered\Geotechnical Engineering Report\BrownBearCarWash_080190\Delivered\01 Site Location Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/6/2019 || User: bgrimm || Print Date: 11/6/2019

Basemap Layer Credits | | Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Copyright:(c) 2014 Esri




DRAFT

Legend

Boring Location

2019 Remedial Excavation Boundary

0 30 60 Feet

Source: Base map provided by Barghausen Consulting Engineers, Inc., dated November 5, 2019.

# Geotechnical Exploration Plan

Car Wash Enterprises
55 NW Gilman Boulevard
Issaquah, Washington

| Aspect Consulting | Nov-2019 | BY: RK/CMV | FIGURE NO. 2 |
|---|---|---|---|
| | PROJECT NO. 080109 | REVISED BY: - | |

CAD Path: Q:_GeoTech\080109 Car Wash Enterprises\2019-11 Issaquah Site\080109-02.dwg F2 || Date Saved: Nov 06, 2019 4:08pm || User: cvanslyke

# APPENDIX A

# Subsurface Explorations

# A.1 Field Exploration Program

## A.1.1 Hollow-Stem Auger Borings

On October 18, 2019, Aspect Consulting, LLC (Aspect) completed two machine-drilled borings (designated ASB-01 and ASB-02) at the Site. The machine-drilled borings were advanced with hollow-stem auger drilling methods using a CME 75 truck-mounted drill rig operated by Cascade Drilling under subcontract to Aspect.

In the machine-drilled borings, disturbed soil samples were obtained at 2.5- and 5-foot intervals by driving a 2-inch split-barrel sampler (SPT sampler) 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows required to drive the sampler 18 inches is recorded in three 6-inch intervals. The number of blows required to drive the sampler the last two intervals is known as the blow count. The blow count provides a measure of relative density or consistency of granular and cohesive soils, respectively.

An Aspect geotechnical engineer was present throughout the exploration program to observe the drilling procedures, assist in sampling, and to prepare descriptive logs of the explorations. Soils were identified in general accordance with ASTM International (ASTM) D2488, *Standard Practice for Description and Identification of Soils* (*Visual-Manual Procedure)* (ASTM, 2018). The summary exploration logs represent our interpretation of the contents of the field logs. The stratigraphic contacts shown on the individual summary logs represent the approximate boundaries between soil types; actual transitions may be more gradual. The subsurface conditions depicted are only for the specific date and locations reported; therefore, are not necessarily representative of other locations and times.

Upon completion, the machine-drilled borings were backfilled with 3/8-inch bentonite chips in accordance with requirements of the Washington State Department of Ecology.

| | | | | |
|---|---|---|---|---|
| Coarse-Grained Soils - More than 50%[1] Retained on No. 200 Sieve | Gravels - More than 50%[1] of Coarse Fraction Retained on No. 4 Sieve | ≤5% Fines | GW | Well-graded GRAVEL<br>Well-graded GRAVEL WITH SAND |
| | | | GP | Poorly-graded GRAVEL<br>Poorly-graded GRAVEL WITH SAND |
| | | ≥15% Fines | GM | SILTY GRAVEL<br>SILTY GRAVEL WITH SAND |
| | | | GC | CLAYEY GRAVEL<br>CLAYEY GRAVEL WITH SAND |
| | Sands - 50%[1] or More of Coarse Fraction Passes No. 4 Sieve | ≤5% Fines | SW | Well-graded SAND<br>Well-graded SAND WITH GRAVEL |
| | | | SP | Poorly-graded SAND<br>Poorly-graded SAND WITH GRAVEL |
| | | ≥15% Fines | SM | SILTY SAND<br>SILTY SAND WITH GRAVEL |
| | | | SC | CLAYEY SAND<br>CLAYEY SAND WITH GRAVEL |
| Fine-Grained Soils - 50%[1] or More Passes No. 200 Sieve | Silts and Clays Liquid Limit Less than 50% | | ML | SILT<br>SANDY or GRAVELLY SILT<br>SILT WITH SAND<br>SILT WITH GRAVEL |
| | | | CL | LEAN CLAY<br>SANDY or GRAVELLY LEAN CLAY<br>LEAN CLAY WITH SAND<br>LEAN CLAY WITH GRAVEL |
| | | | OL | ORGANIC SILT<br>SANDY or GRAVELLY ORGANIC SILT<br>ORGANIC SILT WITH SAND<br>ORGANIC SILT WITH GRAVEL |
| | Silts and Clays Liquid Limit 50% or More | | MH | ELASTIC SILT<br>SANDY or GRAVELLY ELASTIC SILT<br>ELASTIC SILT WITH SAND<br>ELASTIC SILT WITH GRAVEL |
| | | | CH | FAT CLAY<br>SANDY or GRAVELLY FAT CLAY<br>FAT CLAY WITH SAND<br>FAT CLAY WITH GRAVEL |
| | | | OH | ORGANIC CLAY<br>SANDY or GRAVELLY ORGANIC CLAY<br>ORGANIC CLAY WITH SAND<br>ORGANIC CLAY WITH GRAVEL |
| Highly Organic Soils | | | PT | PEAT and other mostly organic soils |

"WITH SILT" or "WITH CLAY" means 5 to 15% silt and clay, denoted by a "-" in the group name; e.g., SP-SM • "SILTY" or "CLAYEY" means >15% silt and clay • "WITH SAND" or "WITH GRAVEL" means 15 to 30% sand and gravel. • "SANDY" or "GRAVELLY" means >30% sand and gravel. • "Well-graded" means approximately equal amounts of fine to coarse grain sizes • "Poorly graded" means unequal amounts of grain sizes • Group names separated by "/" means soil contains layers of the two soil types; e.g., SM/ML.

Soils were described and identified in the field in general accordance with the methods described in ASTM D2488. Where indicated in the log, soils were classified using ASTM D2487 or other laboratory tests as appropriate. Refer to the report accompanying these exploration logs for details.

1. Estimated or measured percentage by dry weight
2. (SPT) Standard Penetration Test (ASTM D1586)
3. Determined by SPT, DCPT (ASTM STP399) or other field methods. See report text for details.

## GEOTECHNICAL LAB TESTS

| | | |
|---|---|---|
| MC | = | Natural Moisture Content |
| GS | = | Grain Size Distribution |
| FC | = | Fines Content (% < 0.075 mm) |
| GH | = | Hydrometer Test |
| AL | = | Atterberg Limits |
| C | = | Consolidation Test |
| Str | = | Strength Test |
| OC | = | Organic Content (% Loss by Ignition) |
| Comp | = | Proctor Test |
| K | = | Hydraulic Conductivity Test |
| SG | = | Specific Gravity Test |

## CHEMICAL LAB TESTS

***Organic Chemicals***

| | | |
|---|---|---|
| BTEX | = | Benzene, Toluene, Ethylbenzene, Xylenes |
| TPH-Dx | = | Diesel and Oil-Range Petroleum Hydrocarbons |
| TPH-G | = | Gasoline-Range Petroleum Hydrocarbons |
| VOCs | = | Volatile Organic Compounds |
| SVOCs | = | Semi-Volatile Organic Compounds |
| PAHs | = | Polycyclic Aromatic Hydrocarbon Compounds |
| PCBs | = | Polychlorinated Biphenyls |

***Metals***

| | | |
|---|---|---|
| RCRA8 | = | As, Ba, Cd, Cr, Pb, Hg, Se, Ag, (d = dissolved, t = total) |
| MTCA5 | = | As, Cd, Cr, Hg, Pb (d = dissolved, t = total) |
| PP-13 | = | Ag, As, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Tl, Zn (d=dissolved, t=total) |

## FIELD TESTS

| | | |
|---|---|---|
| PID | = | Photoionization Detector |
| Sheen | = | Oil Sheen Test |
| SPT[2] | = | Standard Penetration Test |
| NSPT | = | Non-Standard Penetration Test |
| DCPT | = | Dynamic Cone Penetration Test |

## COMPONENT DEFINITIONS

| *Descriptive Term* | | *Size Range and Sieve Number* |
|---|---|---|
| Boulders | = | Larger than 12 inches |
| Cobbles | = | 3 inches to 12 inches |
| Coarse Gravel | = | 3 inches to 3/4 inches |
| Fine Gravel | = | 3/4 inches to No. 4 (4.75 mm) |
| Coarse Sand | = | No. 4 (4.75 mm) to No. 10 (2.00 mm) |
| Medium Sand | = | No. 10 (2.00 mm) to No. 40 (0.425 mm) |
| Fine Sand | = | No. 40 (0.425 mm) to No. 200 (0.075 mm) |
| Silt and Clay | = | Smaller than No. 200 (0.075 mm) |

## ESTIMATED[1] PERCENTAGE

| *% by Weight* | | *Modifier* | *% by Weight* | | *Modifier* |
|---|---|---|---|---|---|
| <1 | = | Subtrace | 15 to 25 | = | Little |
| 1 to <5 | = | Trace | 30 to 45 | = | Some |
| 5 to 10 | = | Few | >50 | = | Mostly |

## MOISTURE CONTENT

| | | |
|---|---|---|
| Dry | = | Absence of moisture, dusty, dry to the touch |
| Slightly Moist | = | Perceptible moisture |
| Moist | = | Damp but no visible water |
| Very Moist | = | Water visible but not free draining |
| Wet | = | Visible free water, usually from below water table |

## RELATIVE DENSITY

***Non-Cohesive or Coarse-Grained Soils***

| *Density*[3] | | *SPT*[2] *Blows/Foot* | *Penetration with 1/2" Diameter Rod* |
|---|---|---|---|
| Very Loose | = | 0 to 4 | ≥ 2' |
| Loose | = | 5 to 10 | 1' to 2' |
| Medium Dense | = | 11 to 30 | 3" to 1' |
| Dense | = | 31 to 50 | 1" to 3" |
| Very Dense | = | > 50 | < 1" |

## CONSISTENCY

***Cohesive or Fine-Grained Soils***

| *Consistency*[3] | | *SPT*[2] *Blows/Foot* | *Manual Test* |
|---|---|---|---|
| Very Soft | = | 0 to 1 | Penetrated >1" easily by thumb. Extrudes between thumb & fingers. |
| Soft | = | 2 to 4 | Penetrated 1/4" to 1" easily by thumb. Easily molded. |
| Medium Stiff | = | 5 to 8 | Penetrated >1/4" with effort by thumb. Molded with strong pressure. |
| Stiff | = | 9 to 15 | Indented ~1/4" with effort by thumb. |
| Very Stiff | = | 16 to 30 | Indented easily by thumbnail. |
| Hard | = | > 30 | Indented with difficulty by thumbnail. |

## GEOLOGIC CONTACTS

Observed and Distinct — Observed and Gradual — Inferred

Aspect CONSULTING

# Exploration Log Key

AI Path: Q:_ACAD Standards\FIELD REFERENCE\MASTERS\Exploration Log Key-2018.ai // user: jinman // last saved: 09/26/2018

| Aspect CONSULTING | Brown Bear - Issaquah - 080109 | | Geotechnical Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>55 NW Gilman Blvd Issaquah, WA 98027, W of Chevron Station, SE of ASB-02 | | *Coordinates (Lat,Lon WGS84)*<br>47.53796, -122.03722 (est) | *Exploration Number*<br>**ASB-01** |
| *Contractor*<br>Cascade | *Equipment*<br>CME 75 truck rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>77' (est) | |
| *Operator*<br>James | *Exploration Method(s)*<br>Hollow stem auger | *Work Start/Completion Dates*<br>10/18/2019 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>15' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50 | Blows/6" | Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **Fill**<br>SILTY GRAVEL WITH SAND (GM); medium dense to dense, slightly moist to moist, brown-gray to brown; fine to coarse sand; fine to coarse gravel | |
| | 75 | Boring backfilled with bentonite chips. | | | 16<br>24<br>25 | Sheen =None<br>Odor =None<br>PID =0 | | | |
| 5 | | | | | 12<br>17<br>6 | Sheen =None<br>Odor =None<br>PID =0 | | | 5 |
| | 70 | | | | 9<br>10<br>12 | Sheen =None<br>Odor =None<br>PID =1.3 | | increased silt content, becomes brown. | |
| 10 | | | | | 3<br>6<br>6 | Sheen =Slight<br>Odor =Faint petroleum-like<br>PID =4.3 | | | 10 |
| | 65 | | | | 2<br>3<br>5 | ASB-01-12.5<br>Sheen =Moderate<br>Odor =Strong petroleum-like<br>PID =114.3 | | **Alluvium**<br>SANDY SILT (ML); medium stiff, very moist, gray; low to medium plasticity; fine to medium sand | |
| 15 | | ▽ 10/18/2019 | | | 4<br>3<br>7 | ASB-01-15.0<br>Sheen =HS<br>Odor =Faint petroleum-like<br>PID =34.5 | | SILTY GRAVEL WITH SAND (GM); dense, wet, brown-gray; fine to coarse sand; fine to coarse gravel | 15 |
| | 60 | | | | 12<br>19<br>7 | ASB-01-17.5<br>Sheen =Slight<br>Odor =None<br>PID =1.3 | | | |

**Legend**

Sample Type
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢⊣ Liquid Limit

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: IVT
Approved by: RPK

**Exploration Log ASB-01**
Sheet 1 of 2

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\080109 - BROWN BEAR ISSAQUAH.GPJ November 6, 2019

| Aspect CONSULTING | Brown Bear - Issaquah - 080109 | | Geotechnical Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>55 NW Gilman Blvd Issaquah, WA 98027, W of Chevron Station, SE of ASB-02 | | *Coordinates (Lat,Lon WGS84)*<br>47.53796, -122.03722 (est) | *Exploration Number*<br>**ASB-01** |
| *Contractor*<br>Cascade | *Equipment*<br>CME 75 truck rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>77' (est) | |
| *Operator*<br>James | *Exploration Method(s)*<br>Hollow stem auger | *Work Start/Completion Dates*<br>10/18/2019 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>15' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Blows/foot ▲ Water Content (%) ● 0 10 20 30 40 50 | Blows/6" | Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 7<br>16<br>32 | ASB-01-20.0<br>Sheen =Slight<br>Odor =None<br>PID =2.8 | | SILTY GRAVEL WITH SAND (GM); dense, wet, brown-gray; fine to coarse sand; fine to coarse gravel (continued) | |
| | 55 | | | | 11<br>12<br>15 | ASB-01-22.5<br>Sheen =None<br>Odor =None<br>PID =< 1 ppm | | SILTY SAND (SM); medium dense, wet, brown-gray; fine to medium sand<br>SILTY GRAVEL WITH SAND (GM); medium dense, wet, brown-gray; fine to coarse sand; fine to coarse gravel | |
| 25 | | | | | 24<br>28<br>31 | ASB-01-25.0<br>Sheen =None<br>Odor =None<br>PID =1.0 | | SAND WITH SILT (SP-SM); very dense, wet, brown-gray; medium to coarse sand<br>SILTY GRAVEL WITH SAND (GM); very dense, wet, brown-gray; fine to coarse sand; fine to coarse gravel | 25 |
| | 50 | | | | 25<br>38<br>27 | Sheen<br>=Slight<br>Odor =None<br>PID =15.7 | | SAND WITH SILT (SW-SM); very dense, wet, brown-gray; fine to coarse sand | |
| 30 | | | | | 27<br>20<br>23 | Sheen<br>=Slight<br>Odor =None<br>PID =12.4 | | SILTY GRAVEL WITH SAND (GM); dense, wet, brown-gray; fine to coarse sand; fine to coarse gravel | 30 |
| | 45 | | | | | | | Bottom of exploration at 31.5 ft. bgs.<br><br>Note: Boring elevations not surveyed for this project. | |
| 35 | | | | | | | | | 35 |
| | 40 | | | | | | | | |

**Legend**

Sample Type
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢⟶⊣ Liquid Limit

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: IVT
Approved by: RPK

**Exploration Log ASB-01**
Sheet 2 of 2

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\080109 - BROWN BEAR ISSAQUAH.GPJ November 6, 2019

| Aspect CONSULTING | Brown Bear - Issaquah - 080109 | | Geotechnical Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>55 NW Gilman Blvd Issaquah, WA 98027, W of Chevron Station, NW of ASB-01 | | *Coordinates (Lat,Lon WGS84)*<br>47.53808, -122.03733 (est) | *Exploration Number*<br>**ASB-02** |
| *Contractor*<br>Cascade | *Equipment*<br>CME 75 truck rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>77' (est) | |
| *Operator*<br>James | *Exploration Method(s)*<br>Hollow stem auger | *Work Start/Completion Dates*<br>10/18/2019 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>12.5' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50 | Blows/6" | Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **Fill**<br>SILTY GRAVEL WITH SAND (GM); medium dense, very moist, brown; fine to coarse sand; fine gravel | |
| | 75 | Boring backfilled with bentonite chips. | | | 10<br>10<br>11 | Sheen =None<br>Odor =None<br>PID =1.4 | | | |
| 5 | | | | | 4<br>7<br>8 | Sheen =None<br>Odor =None<br>PID =<1 ppm | | | 5 |
| | 70 | | | | 8<br>12<br>16 | Sheen =None<br>Odor =None<br>PID =1.1 | | | |
| 10 | | | | | 15<br>17<br>19 | ASB-02-10.0<br>Sheen =Slight<br>Odor =None<br>PID =<1 ppm | | becomes dense | 10 |
| | 65 | ▽ 10/18/2019 | | | 11<br>28<br>25 | ASB-02-12.5<br>Sheen =Moderate<br>Odor =Faint petroleum-like<br>PID =9.9 | | **Alluvium**<br>SILTY GRAVEL WITH SAND (GM); very dense, wet, brown-gray; fine to coarse sand; fine to coarse gravel | |
| 15 | | | | | 7<br>12<br>11 | ASB-02-15.0<br>Sheen =Moderate<br>Odor =Petroleum-like<br>PID =53.6 | | | 15 |
| | 60 | | | | 13<br>50/6" | ASB-02-17.5<br>Sheen =Slight<br>Odor =None<br>PID =1.3 | | | |

**Legend**

Sample Type
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢—⊣ Liquid Limit

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: IVT
Approved by: RPK

**Exploration Log ASB-02**
Sheet 1 of 2

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\080109 - BROWN BEAR ISSAQUAH.GPJ November 6, 2019

| Aspect CONSULTING | Brown Bear - Issaquah - 080109 | | Geotechnical Exploration Log | |
|---|---|---|---|---|
| | *Project Address & Site Specific Location*<br>55 NW Gilman Blvd Issaquah, WA 98027, W of Chevron Station, NW of ASB-01 | | *Coordinates (Lat,Lon WGS84)*<br>47.53808, -122.03733 (est) | *Exploration Number*<br>**ASB-02** |
| *Contractor*<br>Cascade | *Equipment*<br>CME 75 truck rig | *Sampling Method*<br>Autohammer; 140 lb hammer; 30" drop | *Ground Surface (GS) Elev. (NAVD88)*<br>77' (est) | |
| *Operator*<br>James | *Exploration Method(s)*<br>Hollow stem auger | *Work Start/Completion Dates*<br>10/18/2019 | *Top of Casing Elev. (NAVD88)*<br>NA | *Depth to Water (Below GS)*<br>12.5' (ATD) |

| Depth (feet) | Elev. (feet) | Exploration Completion and Notes | Sample Type/ID | Blows/foot ▲ Water Content (%) ● 0 10 20 30 40 50 | Blows/6" | Tests | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 50/6" | ASB-02-20.0<br>Sheen =Slight<br>Odor =None<br>PID =<1 ppm | | SAND WITH SILT (SP-SM); very dense, wet, brown-gray; fine to coarse sand | |
| | | | | | | | | SILTY GRAVEL WITH SAND (GM); very dense, wet, brown-gray; fine to coarse sand, fine to coarse gravel | |
| | 55 | | | | 5/6" | ASB-02-22.5<br>Sheen =Slight<br>Odor =None<br>PID =<1 ppm | | silt (ML) interbed (2" thick) | |
| 25 | | | | | 10<br>25<br>30 | ASB-02-25.0<br>Sheen =None<br>Odor =None<br>PID =1.4 | | SILTY SAND (SM); very dense, wet, brown-gray; slow dilatancy; fine to coarse sand | 25 |
| | 50 | | | | | | | fine to coarse gravel layer (3" thick) | |
| | | | | | 11<br>27<br>42 | Sheen =None<br>Odor =None<br>PID =2.7 | | SILTY SAND WITH GRAVEL (SM); very dense, very moist, brown-gray to light brown; fine to coarse sand; fine gravel | |
| 30 | | | | | 32<br>50/6" | Sheen =None<br>Odor =None<br>PID =1.2 | | increased silt content | 30 |
| | | | | | | | | Bottom of exploration at 31 ft. bgs.<br>Note: Boring elevations not surveyed for this project. | |
| | 45 | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| 35 | | | | | | | | | 35 |
| | 40 | | | | | | | | |

**Legend**

Sample Type
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢⊣ Liquid Limit

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: IVT
Approved by: RPK

**Exploration Log ASB-02**
Sheet 2 of 2

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\080109 - BROWN BEAR ISSAQUAH.GPJ November 6, 2019

# APPENDIX B

# Report Limitations and Guidelines for Use

# REPORT LIMITATIONS AND GUIDELINES FOR USE

## This Report and Project-Specific Factors

Aspect Consulting, LLC (Aspect) considered a number of unique, project-specific factors when establishing the Scope of Work for this project and report. You should not rely on this report if it was:

- Not prepared for you
- Not prepared for the specific purpose identified in the Agreement
- Not prepared for the specific real property assessed
- Completed before important changes occurred concerning the subject property, project or governmental regulatory actions

## Geoscience Interpretations

The geoscience practices (geotechnical engineering, geology, and environmental science) require interpretation of spatial information that can make them less exact than other engineering and natural science disciplines. It is important to recognize this limitation in evaluating the content of the report. If you are unclear how these "Report Limitations and Use Guidelines" apply to your project or site, you should contact Aspect.

## Reliance Conditions for Third Parties

This report was prepared for the exclusive use of the Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against liability claims by third parties with whom there would otherwise be no contractual limitations. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with our Agreement with the Client and recognized geoscience practices in the same locality and involving similar conditions at the time this report was prepared

## Property Conditions Change Over Time

This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by events such as a change in property use or occupancy, or by natural events, such as floods, earthquakes, slope instability, or groundwater fluctuations. If any of the described events may have occurred following the issuance of the report, you should contact Aspect so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

## Discipline-Specific Reports Are Not Interchangeable

The equipment, techniques, and personnel used to perform a geotechnical or geologic study differ significantly from those used to perform an environmental study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually address any environmental findings, conclusions, or recommendations (e.g., about the likelihood of encountering underground storage tanks or regulated contaminants). Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding the subject property.

We appreciate the opportunity to perform these services. If you have any questions please contact the Aspect Project Manager for this project.

# Tab 8.0

## 8.0 OTHER PERMITS

- City of Issaquah Building Permit
- City of Issaquah Grading Permit
- City of Issaquah Right-of-way Permit
- City of Issaquah Fire Permit
- City of Issaquah Sign Permit

# Tab 9.0

## 9.0 OPERATIONS AND MAINTENANCE MANUAL

An Operations and Maintenance Manual will be provided in this section during Final Engineering Review.

# Tab 10.0

## 10.0 DECLARATION OF COVENANT FOR PRIVATELY MAINTAINED FLOW CONTROL AND TREATMENT FACILITIES

A Declaration of Covenant for Maintenance and Inspection of Onsite Stormwater BMPs will be provided in this section during final engineering review.

# Tab 11.0

## 11.0 DECLARATION OF COVENANT FOR PRIVATELY MAINTAINED ON-SITE STORMWATER MANAGEMENT BMPS

A Declaration of Covenant for Maintenance and Inspection of Onsite Stormwater BMPs will be provided in this section during final engineering review.

# Tab 12.0

## 12.0 BOND QUANTITIES WORKSHEET

A completed Bond Quantities Worksheet will be provided in this section during Final Engineering Review.